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ENGINEERING AND MINING JOURNAL

METAL AND NON-METALLIC MINING · MILLING · SMELTING · REFINING · MARKETING

Is the Price of Tin Too Far Above Production Cost?

A. B. Parsons shows that the margin of profit has been large and that new dredge equipment and possibly curtailed consumption are likely to bring prices down 5 to 10 cents a pound

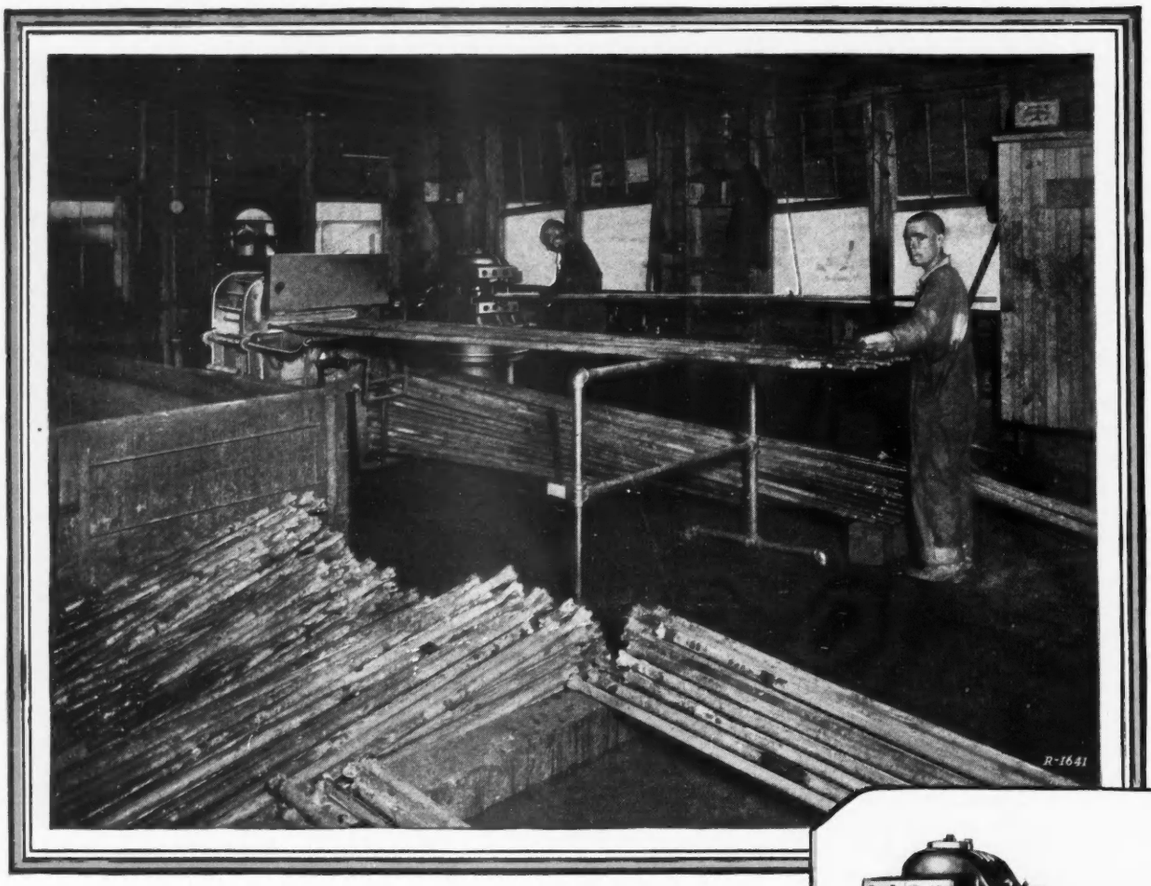
Can a Prospector Make Money in an Old Mining District?

Jay Carpenter describes the Flowery mine and cyanide plant at Virginia City, Nevada. He tells how two old-timers staged a come-back on the Comstock Lode, and are making money

When Copper Furnace Capacities Were Thirty Tons Per Day

Arthur L. Walker continues his reminiscences of early days in the Globe district. Coke had to be hauled 130 miles by wagon, cost 3 cents per pound, and slags ran 3 per cent copper

BEGINNING NEXT WEEK: *The Harris Process of Refining Lead*



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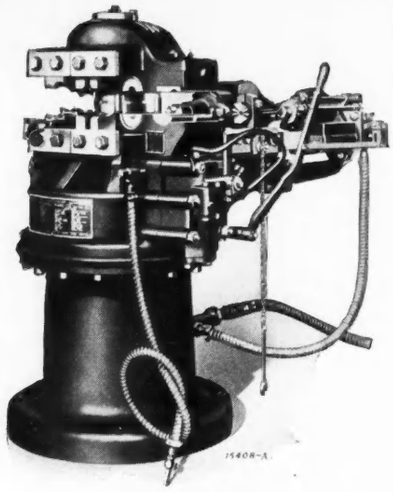

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ENGINEERING AND
MINING JOURNAL

McGraw-Hill Publishing Company, Inc.
JAMES H. MCGRAW, *President*

A. W. ALLEN,
Editor

VOLUME 125 — *New York, April 28, 1928* — NUMBER 17

Thrill

HEROES of this age and time claim our homage not through success at arms, or politics, or sport. Theirs no country and no people. They belong to all the world. These sons of Man and of the Spirit are dear to the hearts of every nation by virtue of a quality that bespeaks the brotherhood of nations.

They rise into the Unknown, and are gone, their journey's end—their destiny—hid in the veil of Time. A world waits in suspense. From out the ether a word flashes: they are safe. The peoples of the earth rejoice. Pessimism, Doubt, Hate, and all unloveliness dissolve in joy awakened by valorous accomplishment. An inner light illumines and gives voice to what is worthy in the emotions of men. Beggar and Crœsus are on common ground. In the now of the epoch-making conquest of the air, and of the subjugation of Time and Space by the magic touch of captive Force and Light, all humanity has part. Von Huenefeld, Fitzmaurice, Koehl! Welcome, seed of Germania and of Erin!

The Rôle of Copper in Human Metabolism

SIGNIFICANT conclusions have been reached in recent years to show the essential need for such elements as iodine, calcium, and phosphorus in the functioning of the human body. The study of vitamins, in addition, has thrown light on the rôle of certain elusive substances in minute amounts that exercise a powerful influence on health. Now one learns that the value of iron as a preventive of anæmia has been overestimated or misunderstood, and that copper is the influencing factor. This is the verdict of a group of investigators at the University of Wisconsin, whose findings were recently released through the American Society of Biological Chemists.

Copper occurs in minute amount in milk, and its presence is suspected in liver—a food that recently became so popular as a remedy for anæmia that prices soared. The Wisconsin investigators, suspecting the presence of copper in liver, prescribed various copper salts in the treatment of anæmic rats, with astonishing results. The outcome was so satisfactory and so positive that hospital patients are to be experimented with; and it is not at all unlikely that proof will be forthcoming that copper plays an important part in the preservation of health and the prevention of disease.

One is inclined to wonder if the radical steps taken in recent years to insure "pure" foods have not resulted in the exclusion of essential body elements and compounds. Few substances are not poisonous if taken in sufficient quantity; but it seems illogical to outlaw some of these because they are more toxic than others. Copper as a dye is barred from foodstuffs, in spite of the minute quantity necessary; but no proof has been adduced that the familiar French canned peas are more harmful than the domestic brands, and it is not unreasonable to suppose that the minute amount of copper present might act as a corrective. It is more than probable that certain elements act as catalytic agents in the human body, remaining undissolved and unchanged, although performing vital functions in permitting reactions of far-reaching effect. Copper compounds may be and doubtless are adsorbed on foodstuffs and on organic cells, and as such they should not be classed as toxic poisons.

The propaganda against copper because of the poisonous effects of overdosage, and the resultant tendency to discountenance the inclusion of even a minute amount in foodstuffs, may be positively harmful. The existing thorough control over the manufacture of foodstuffs is doubtless desirable and necessary, but it should not be forgotten that an exclusive diet of "pure" food would merely invite illness and complication.

The next few years will doubtless see the collapse of many cherished notions. Research in the realm of the unnoticeable may explain why perfect health is so often associated with a complete disregard for those niceties and refinements that aim to avoid "contamination" of what is to be eaten.

Modernization and Mechanization in Competitive Fields

EXCESS capacity in some of the mineral industries operates to create a precarious position for those producing at a cost above the average. In cement, for instance, the margin between sales price and operating cost is relatively small. It would appear that capital would be chary of adventuring into an industry already well served, but such is not the fact.

Modern technology opens up new possibilities in old industries. Mechanical appliances of greatly improved design are available. Better methods are being adopted in management and marketing.

Thus the capitalist, under competent advice, may enter a highly competitive industry and secure in a short time a strong position, by reason of a modern or modernized plant and improved methods, resulting in lower costs. The older plant is at a disadvantage. The new com-

petitor may cut prices to a level that will make the long-established plant unprofitable.

Old plants, if they are to survive, must be modernized and re-equipped. The revolutionary changes that have taken place in ore-dressing practice within the last fifteen years have widely influenced crushing, grinding, screening, and material-handling in the non-metallic industries. The efficiency of equipment, process and management methods needs frequent appraisal. If a manager does not recognize the value of the advantages of present-day knowledge, improved equipment, and modern methods, his competitor may take the profits.

The Boulder Dam; or, Cheap Power for Mining

FEW SUBJECTS so complex have engaged national interest in the last few years as the project of building a dam across the Colorado River at Boulder Canyon, between Arizona and Nevada, where the river turns toward the south. A controversy has arisen involving state, national, and international rights; one in which flood control, irrigation development, silt control, and power development are concerned; and one that affords a battle ground between the proponents of private and government ownership and operation. Most of these subjects are far removed from the province of *Engineering and Mining Journal*. Perhaps the sole direct interest of the mining industry in the project is as to whether or not the proposed dam will afford sufficiently cheap power to aid materially in the development of the adjoining mining districts of Nevada, California, and Arizona; and whether or not its construction will result in any material addition to the taxes paid by the mining companies. The mining industry also has an indirect interest in the subject, in that, if agriculture and manufacturing are stimulated in the districts the dam will serve, the cost of equipment and supplies may be less.

Cheap power is, of course, highly desirable for the development of any mining industry. Omitting from consideration, initial cost of equipment and the cost of distribution, power can be generated locally in the Southwest for a cent or less per kilowatt-hour, at least by companies which are prepared to use a minimum of several hundred horsepower. The cost of power at the proposed Boulder Dam will depend on the apportionment of cost between various beneficiaries, and what is charged for interest on the investment and for profit. Presumably, a rate would be made below the cost of privately generated power from oil or coal, at least for those in districts where a good block could be taken and who would be not too far from the source. As the cost for power and labor are the two major items in the operation of most mining enterprises, a reduction of 25 to 50 per cent in the power cost might well be the equivalent of one or two cents additional in the selling price of the metal produced. For an electrolytic refinery, such as is soon to be built in the Southwest, the power item is dominant.

Mr. Lewis W. Douglas, son of James S. Douglas of mining fame, who is now a representative in Congress from Arizona, recently stated, in opposing the Colorado River Development bill, that "to purchase power from the Colorado River would cost mining companies a great deal more than it costs them to develop their own power through the utilization of waste heat," explaining in some detail the economies that have been secured by the installation of waste-heat boilers in connection with reverberatory furnaces, as contrasted to the blast furnaces that some of the companies formerly used. It is true that this power is generated at what is negligible cost, but its amount is strictly limited by the tonnage of concentrates smelted. Only those companies that have smelters can get power from this source, and usually it is even then not sufficient for carrying on the accompanying mining and concentrating operations. The small companies, or those without smelters, are in the aggregate much more important than those privileged to get power from waste heat. In other words, less power is generated as a smelter byproduct in the Southwest than is generated by other means or purchased for use in the mining industry. The small operator must be considered.

Therefore, *Engineering and Mining Journal* supports, in principle, any project that will insure cheaper power without a proportionate increase in taxes to offset it. As between the various projects for the construction of a dam across the Colorado River, so many other considerations foreign to the mining industry must be taken into account that an opinion need not be ventured here.

Hydraulic Mining in California

AS A RESULT of the work of the Mineral Resources Committee of the Commonwealth Club of San Francisco, in behalf of hydraulic mining in California, certain newspapers of that state have assumed an extreme position in opposition to any hydraulic mining at all. As an example, *The Bulletin,* of San Francisco, recently editorialized as follows:

"Hydraulic mining and agriculture cannot get along together. The farmer may not be able to injure the hydraulic miner, but the hydraulic miner can injure the farmer, and always has injured him.

"It is unfortunate that we appear to be on the eve of reviving the old and bitter fight between mining and farming in California, but if it is to be revived *The Bulletin* will be on the side of the farmer, on the side of irrigation, of water conservation and the prevention of floods."

The Bulletin shows a lamentable ignorance of facts. The hydraulic miners are few and far between; the agriculturists are numerous. Hydraulic mining has been practiced in California for many years, and nobody is being injured. The extent of proposed new mining operations is relatively small and is confined to but few localities. Present-day conditions are such that no extensive resumption of hydraulic mining is possible. The most that can be done is to improve these conditions, and that is all that the miners are asking. Agriculture, present or future, is in no danger. Intelligent agriculturists are not opposed to hydraulic mining, but rather approve of it; they are ready to give the miner a sporting chance. If he can make a "go" of it under present conditions, well and good.

The attitude of *The Bulletin,* of the *Sacramento Bee,* and of a few interested lawyers and spokesmen for the extremists is at variance with the facts of the case. Hydraulic miners are entitled to consideration. The committee under Mr. Walter Stalder has rendered a constructive service to California and the mining industry of the state in bringing out important facts. The expansion of hydraulic mining in a limited way, and with due consideration to the agricultural, power, and harbor interests, seems to be possible.

An Open Letter to a Contemporary

PATIENCE IS A VIRTUE; but it ceases to be one when passivity merely permits the continued spread of garbled misinformation taken from copyrighted articles. For this reason we are constrained to object to the habitual "borrowing" of *E. & M. J.* market and financial data and comments by the Arizona "Mining Journal," without credit, and the issuance by that publication of a "Digest of the Metal Situation" that has neither significance nor value unless the original date of publication of the information can be ascertained and taken into consideration.

The material for this "digest" apparently comes from two main sources: the monthly reports of the American Bureau of Metal Statistics and the weekly issues of *Engineering and Mining Journal.* The excerpts that follow will substantiate the charge so far as this publication is concerned:

"Engineering and Mining Journal," issue of March 3, with Market Report dated Feb. 29	*Arizona "Mining Journal," issue of March 15, 1928*
"This is the first time since July, 1923, that lead has touched 6c. London has been persistently weak, and this has been reflected in the domestic market."	"The last time that lead was down as low as 6 cents was in the summer of 1923. It has been the weakness of the London market which has dragged the domestic price down . . ."
"The large producers persist courageously, if monotonously, to hold the domestic price on the basis of 14.125c., delivered in Connecticut. . . . Custom smelters, however, got to the point where they felt they had to sell; and the 14c. level was cut through to obtain business."	"The copper producers are persistent in their policy holding tight to the price of 14⅛ F.O.B. Connecticut points which is about 13.90 F.O.B. mines. The market generally is an eighth less than the price being held for by the producers and they seem willing to hold their metal rather than concede any price drop. The custom smelters have been making price concessions below the 14 cent mark and, of course, getting what sales were to be had."
"The export association still maintains its c.i.f. price at 14.50c., which corresponds approximately with the nominal price of 14.125c., Connecticut. February sales, abroad, are estimated at 25,000 tons, which is a drastic decline from those of January."	"Export copper remains at 14.50 F.O.B. European points which corresponds with about 13.90 F.O.B. mines. While the figures on February shipments are not yet fully compiled and available, it is stated that exports for February will show a tremendous drop from the January totals."

We ignore absurdities that are apparent to those familiar with the metal markets, such as "F.O.B. mines" and "F.O.B. European points." However, by using the word "exports" instead of "sales" the Arizona "Mining Journal" makes the statement erroneous. The fact is that shipments in February exceeded those of January by 4,000 tons. It might also be mentioned that the 22½-point differential between refinery and Connecticut prices is exactly that determined by *E. & M. J.* exclusively.

"Engineering and Mining Journal," issue of March 3	*Arizona "Mining Journal," issue of March 15, 1928*
"In my opinion there will be some shrinkage in metal imports into Germany in 1928 compared with 1927. . . . In general, metal people here are convinced that the thorough and best measure to increase use of copper is to keep it cheap."*	"It is felt by students of the German industrial situation that Germany cannot be expected to consume as much metal this year as last although it should be close up to the 1927 figures. The German idea is that, in order to produce volume business on the metal products it is necessary to keep it cheap and that a rising price tendency will slow down business."

*From a "Review of the German Metal Situation," by Dr. James Rubinfeld, special correspondent in Berlin of *Engineering and Mining Journal.*

"Potential overproduction exists in most industries, manufacturing as well as exploitation of raw materials being in the same position. But the real trouble is what may be called for want of a better term 'unintelligent' marketing practices. 'Cut-throat' and 'ruthless' are the terms applied to the kind of competition that is wiping out the profit of highly efficient production. . . . Mr. Tuthill . . . thinks that the one action that gives hope of practical results within a reasonable period of time is to obtain a modification of the anti-trust and restraint-of-trade laws."

"Frankness in an analysis of the metal situation in the United States was recently given in New York by Stephen S. Tuthill, secretary of the American Zinc Institute. His analysis was, briefly, that the trouble is not actual overproduction, although a potential overproduction exists. 'The real trouble is what may be called for the want of a better term "unintelligent" market practices. "Cut-throat" and "ruthless" are the terms applied to the kind of a competition that is wiping out the profit of highly efficient production.' Mr. Tuthill believes that the answer lies in a modification of the anti-trust and restraint-of-trade laws."

The Arizona "Mining Journal" carelessly puts words into the mouth of Mr. Tuthill that he never uttered. The sentence quoted was written by the representative of *Engineering and Mining Journal* who reported the meeting.

Mining company dividend figures are compiled, totaled, and issued by *Engineering and Mining Journal* at monthly intervals. The figures in the adjoining statement will be found in the following issues:

Feb. 25, 1928, p. 255.
Dec. 10, 1927, p. 953.
Aug. 27, 1927, p. 355.
Feb. 26, 1927, p. 387.

They are meaningless without the tables and explanatory notes that accompany them in the *E. & M. J.*

Arizona "Mining Journal," issue of March 15, 1928

"The present weak metal market is reflected somewhat into the dividend disbursements for February which totaled $17,336,-445 as against $17,846,584 for the month of November, the corresponding quarterly period. They are, however, better than the previous quarter, when $16,965,732 was disbursed in August and over a million dollars better than during February of last year, when $16,137,913 was paid to mining company stockholders."

For the benefit of all concerned, and putting aside a false modesty that would only becloud the issue, it is perhaps necessary to state that *Engineering and Mining Journal* is the only agency that prepares and publishes a reliable weekly review of the non-ferrous metal market from first-hand data. It is able to do this because of a long-established reputation for integrity and by reason of the understanding and co-operation that exist between its editors and the producers and users of non-ferrous metals in New York, St. Louis, and other important mineral and metal centers. Aside from the important daily newspapers throughout the United States that print a brief abstract of the *E. & M. J.* Market Report, numerous daily, weekly, and semi-monthly publications in the mining districts quote these statistics and reports issued from this office on market and other matters; but all these papers give proper acknowledgment of the source of the information.

Our contemporary in Arizona doubtless realizes the accuracy of the figures and the timeliness of the market comments that appear in *Engineering and Mining Journal;* otherwise it would doubtless vary the program by going elsewhere for basic information of this character. It could, of course, apply a little more skill in scissors-and-paste work, and thereby conceal the source of its material. If its clientele still needs *E. & M. J.* information second hand and so long after original publication, we have no objection whatsoever to the reissuance of these data from our market-report section, provided they appear verbatim and unmutilated, with due credit to the original source, and accompanied by the date to which the quotations refer.

Mining Engineers of Note

PERCY E. BARBOUR

VERSATILITY—one gathers from reading page 118 of "Who's Who in Engineering"—is not the least prominent of the characteristics of Col. Percy E. Barbour, secretary of the Mining and Metallurgical Society of America. His principal fields of endeavor aside from engineering—both mining and metallurgical—include journalism, secretaryships, the army, and policing. Reviewing his activities in each of these spheres, disregarding chronological sequence, will give a fair picture of Colonel Barbour's colorful career. He was an occasional contributor to the *Engineering and Mining Journal* for many years and joined the editorial staff in 1915. During the later part of a two-year engagement he acted as managing editor. From 1919 to 1925, while assistant secretary of the American Institute of Mining and Metallurgical Engineers, his principal duties were those connected with the editorship of *Mining and Metallurgy,* the monthly organ of the Institute. Perhaps as exciting, to judge from the name at least, must have been his service on the editorial staff of the *Rio Grande Rattler,* a publication sponsored by the New York State Division of the United States Army in the "war" of the Mexican border in 1916 and 1917. Colonel Barbour was then a Lieutenant in the engineering corps. In addition to the secretaryships already mentioned, the Colonel was for three years secretary of the New York Post of the Society of American Military Engineers. He likewise was one of the charter members and for some years a director of the parent organization. A few months ago Colonel Barbour was being congratulated as the recipient of the gold medal of the Society, awarded "In recognition of the distinguished and meritorious service which you have rendered it [the Society]." His first military service was as a Lieutenant in the Maine Coast Artillery, from 1914 to 1916. Later he was on the Mexican border, and in 1918 he became a captain of engineers in the U. S. Army. He is now a Lieutenant-Colonel in the 342nd Engineers of the Reserve Corps. The Colonel's first enlistment with the civil forces of law and order was in 1907 as a deputy sheriff at Goldfield, Nev. That was during the period when the bonanza camp, only a few years old, but populated with as wild a crew as ever dug gold from the desert hills, was going through the throes of a bitter labor war. Six-shooters and sawed-off shotguns were carried by all and sundry for purposes other than decoration. A deputy sheriff going to work in the morning was by no means certain that he would arrive safely at home in the evening. Colonel Barbour survived, however; and, fortified perhaps with this experience as an upholder of the law, he became in 1918 Deputy Superintendent of New York State troopers, Department of State Police. Nor in respect to mere mining engineering is his career less diversified. He has worked in the field in Utah, Nevada. New Mexico, Idaho, Oregon, Tennessee, and North Carolina. His jobs have ranged from assaying and detailing over a drafting board on mill and smelter construction to managing properties in Bland, New Mexico, and in Candor, North Carolina. In 1926 and 1927 he was on the staff of the St. Joseph Lead Company as assistant manager of the exploration department, with headquarters in New York. Colonel Barbour was born in Portland, Me., in 1875; he obtained his degree as Bachelor of Science from Worcester Polytechnic Institute in 1896 and later took a degree of Civil Engineer in 1908. He became interested in mining as a consequence of an early connection with a Boston firm of ventilating engineers and contractors; and in 1900 he went to Utah as engineer for Bingham Consolidated Copper. He married Viola Grace Hackward in Goldfield, Nev., in 1909. The following extract from a resolution passed by the board of directors reflects the creditable work he did for the A.I.M.E.:

PERCY E. BARBOUR

"The Board of Directors desires to place on record its appreciation of his seven years' service with the Institute and especially to mention his successful conduct of the membership campaign in 1919 and 1920; his reformation of our budget-making system; the reorganization of the accounting department and, particularly, his establishment and conduct of the magazine, *Mining and Metallurgy,* in the editorial and business management of which he has achieved most gratifying success."

Is 45-Cent Tin Likely?

World Situation Reviewed by A. B. PARSONS

NO LONGER AGO than November, 1926, Straits tin was sold at more than 72c. per pound in New York. Recently it was quoted at 50.25c. A decline of 22c., or 30 per cent, in the course of sixteen months, even in a commodity that is notorious for its erratic market fluctuations, indicates that radical changes have taken place in the basic elements of the situation.

One should not conclude from the caption of this article that it is a forecast or a prophecy. It is intended neither as a warning to producers nor a reassurance to consumers; rather, it is a review of the developments that have brought about the slump, and more particularly an inquiry into the factors that will determine the trend in the price during—say—1928 and 1929. In this fast-moving world of ours, speculation as to what may happen to tin five or ten years hence, albeit interesting, is frought with such uncertainty that it is almost futile. Copper, lead, and zinc are staid and well-behaved commodities compared with tin. Yet few in 1920 expected that copper companies would be earning good dividends on 13c. copper in 1927; and still fewer in 1925 thought that lead would be hovering above and zinc below 6c. at the end of 1927. To be sure, there have been good reasons for the behavior of these metals. Looking backward it is clear as day. Likewise, there have been equally good reasons for the decline in tin prices.

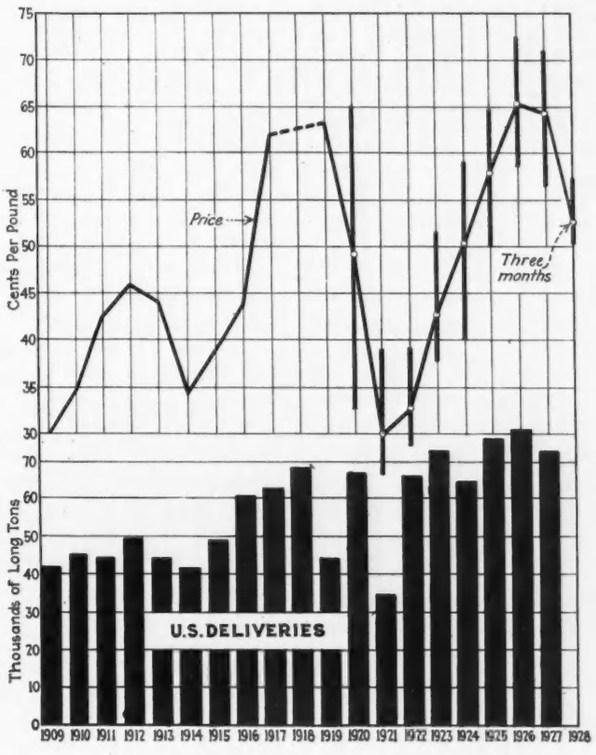


Fig. 1—Tin prices and United States deliveries, showing how the fluctuations roughly correspond. The overlapping of the bars indicating the price range is an evidence of speculative manipulation.

Tin is the medium of a vast amount of speculation, particularly on the London Metal Exchange. This is reflected in Fig. 1, showing annual average prices since 1909 and the range of prices in recent years. The figures are in cents per pound, but essentially the domestic price mirrors London, where the only real open market exists. Even during the period of steady appreciation in the average price, from 1922 to 1926, the bars showing the high-and-low range overlap to an astonishing extent, largely as a consequence of the speculative trading.

Reports of every kind, from an unusually rainy season in Nigeria to an alleged depletion of salmon in the waters of British Columbia, are seized upon as bullish or bearish factors in the tin market. The statistics, particularly the figure for "world's visible supply," are used to an extent out of all proportion to their month-to-month significance. The supply of spot metal being comparatively limited, it is not difficult to engineer squeezes. The big traders alternately take the long and the short side of the market, reaping profits ultimately from the speculating public without in any way affecting the actual position of the metal. Producers profess to look with disfavor upon these speculative fluctuations, asserting that their average realization is less as a consequence of it. As, however, both traders and producers are principally British, and the big customer is the United States, it is fair to assume that any artificial control is in the direction of higher rather than lower prices.

One other aspect of the situation is the continual emphasis placed upon the fact that the known tin resources of the world are comparatively limited. The public is constantly being reminded that a tin famine is sure to arrive, sooner or later, and this undoubtedly has a sentimental bullish effect on the market. In this connection one is reminded of the attitude expressed last year by E. J. Cornish, president of the National Lead Company, largest consumer of tin in the world. He has no misgivings as to the adequacy of the supply of any of the metals. Nature, in its limitless wisdom, will take care of such matters, he thinks. Whatever the need may be, it will be met; though possibly higher prices will be necessary.

Personally, I am inclined to think that the research metallurgist and the chemist ought to have a place in the picture. If and when tin becomes scarce—and perhaps before—substitutes will be found. The chairman of one tin-producing company recently visualized the American public as starving to death if the supply of tin for making plated food containers were suddenly shut off. But if occasion arose it is safe to say that some of the other metals, some alloy, perhaps some organic compound, would be developed to apply as a

coating over sheet iron to take the place of the currently ubiquitous tin can. Regarding this point I shall have something specific to say later in this article. Moreover, aluminum, when 99.75 per cent pure, makes a superior container, one big advantage being that the loss by spoilage is virtually eliminated. Just what the prices for the two metals would have to be to make the economic equation favor the use of aluminum, I do not know; but the tendency of the aluminum price seems to be downward, and if tin goes far enough in the opposite direction aluminum eventually should be used.

On the other side of the picture is the technical advance, not only in the mining and production of concentrates, but in the smelting operations. Recoveries today are not good as compared with those realized on other metals; but the technicians are constantly working, and improvements should result. Obviously, better metallurgy will tend to make profitable the exploitation of leaner ores, and aggregate available resources automatically will be expanded. Industry has never yet "run out" of anything it needed, and it is unlikely that tin will set a new precedent.

But even those who are most pessimistic regarding the supply of tin foresee at least ten years' supply ahead in the fields that are now known—and this takes no account of the possibilities in vast unexplored—minerally—areas in Africa, Asia, and elsewhere.

The plea is frequently advanced that producers are entitled to higher prices to compensate them for the depletion of the extremely limited reserves, which they

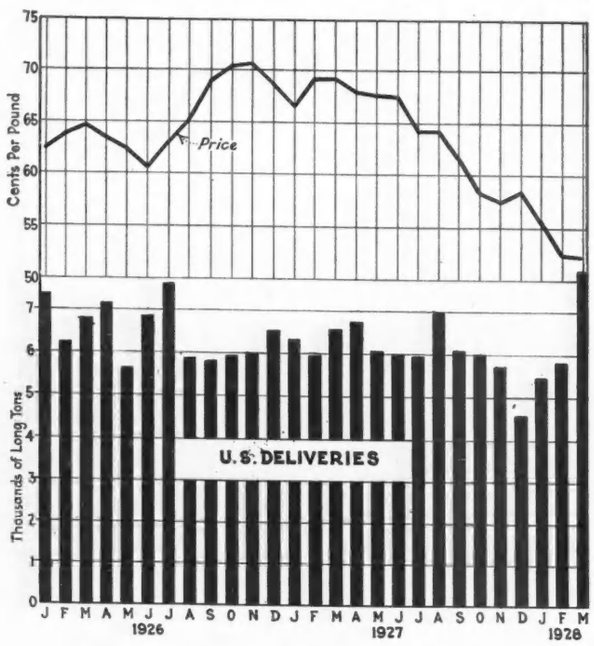


Fig. 2—Monthly prices and deliveries in the United States

imply they are holding as a sort of sacred trust for the benefit of society at large. Without imputing to the owners of tin mines any less altruistic ideals than those cherished by owners of other mines, one may venture the opinion that the only motive that would move them to conserve the supply of tin would be the hope of realizing greater profits for themselves in the long run. Moreover, they realize full well that a profit of $1 today is worth as much as a profit of $2 ten years from now. Accordingly, as long as they are earning good profits for their shareholders it is unlikely that directors of tin-mining enterprises, generally, will adopt a program of curtailment of output. The point I am trying to make is that, in spite of the extraordinary speculative character of the London tin market, and the much-advertised limitations to the world's aggregate known resources of the metal, the policy of the producers and the broad trend of the market are governed by the same economic laws to which other metals and other commodities are subject.

What, then, caused the rapid rise in price, from a low of 29c. in 1922 to a high of 72c. in 1926? In part, of course, this was a natural recovery from the post-war slump; but aside from this the actual excess of demand over newly mined supply was a vital factor. Industrial activity in the United States was at a high rate; the demand for tin-plate and for automobile manufacture was growing, reaching the peak in 1926 as shown in Figs. 1 and 4. The "shortage," prior to 1926, was made up by drawing upon the stocks accumulated in Malaya during the post-war depression. In 1926, as indicated in Fig. 3, world production, principally because of political conditions in China that interfered with mining operations, declined from 145,492 to 143,072 long tons. Consumption was at the maximum in the United States, the cry of impending famine was rampant, and prices soared. But the end of 1926 marked the turning point of the tide. In the first place demand from the United States, which had taken 56 per cent of the world's production in 1926, subsided. Mr. Ford, at whose door the responsibility for so many of the economic reversals of 1927 is laid, suspended production of automobiles; and an exceptionally large carry-over of canned food products, already packed, operated to reduce the requirements of the tin-plate makers. The net result was a decline from 78,300 to 72,400 long tons in United States deliveries. In the meantime the effects of the higher prices in the years immediately preceding had become increasingly important as reflected in expanded production. Increases were recorded in Nigeria, the Dutch East Indies, and in Bolivia, but the greatest expansion was in the Malay States. The fruits of important expenditures on capital account for the efficient equipping of the mines were appearing. In the Dutch Indies larger and better gravel pumps had been installed; in Bolivia mining and ore-treatment operations had been reorganized; in Nigeria, and particularly in Malaya, bigger and better dredges, equipped with efficient classifying and jigging machinery, were put into productive operation, some displacing older types, and others starting operations on deposits where dredges had never been. The decline in prices was the natural consequence.

A striking parallel can be drawn between tin and lead, except that the crest of the lead-price curve was passed about a year sooner. In 1923, 1924, and 1925 industry was warned solemnly of the impending famine in lead. The price went steadily up, passing 10c. for a brief time in 1925. But in the interval potent forces had been at work. Intensive effort was made to expand output to meet the demand. Technicians and engineers collaborated, and with ample money available, production was increased.

The outstanding factor, of course, was the rapid development of selective flotation. Not only did it make available for exploitation great tonnages of "ore" that hitherto had not been workable, but it reduced measurably the average cost of production. The effect of this technical progress culminated toward the close of 1925,

supply exceeded demand, and the trend of the lead market has been consistently downward ever since. From 9.50c. to 6c. is a drop of about 37 per cent, somewhat greater, incidentally, than the drop in tin. The principal concern of the miners of lead has been to keep production within bounds.

For "selective flotation" substitute "electric dredging," and readjust dates and prices slightly, and the story of lead becomes the story of tin, except that it is one chapter behind.

This brings the subject up to date; and supplies a background for some inquiry into the probable market trend in the next two years. For one thing, the foreboding that industry would be hungering for tin that it could not obtain is at least deferred to the middle-distant future. To whatever extent apprehension in this connection may have tended to strengthen the market for the metal, it is no longer a factor so far as 1928 and 1929 are concerned. The question to be answered might be put, "How high a price will be necessary to bring out the quantity of tin that will be required by consumers?" However, under the circumstances, it is reasonable to turn the question around and ask, "How low can the price go without cutting off enough production to create a current 'deficit,' on balance, in the world supply?"

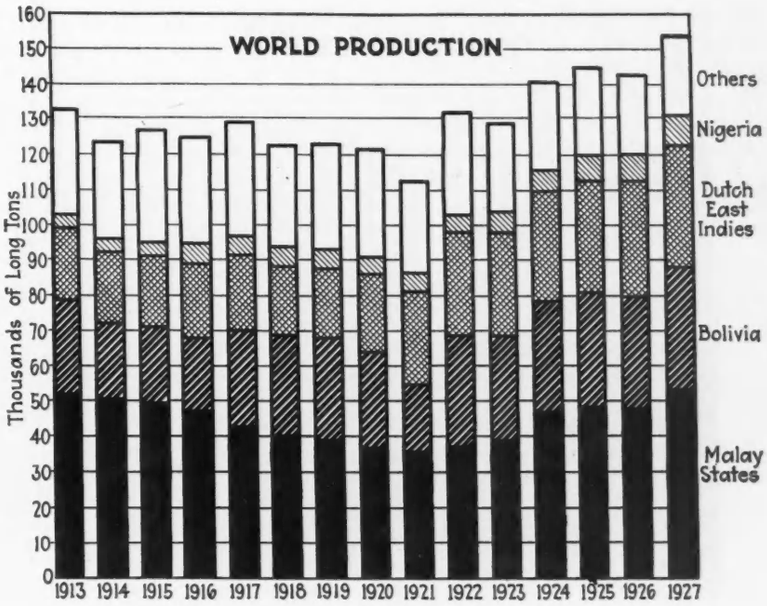


Fig. 3—Production since 1919. "Others" includes China, Siam, Australia, Cornwall, Congo, India, South Africa and Indo-China

One possibility exists that may alter the picture. This is the creation of an international cartel to regulate production and control prices—a project much discussed in London in recent months. There are, however, serious obstacles to such a program. The number of companies engaged in the mining of tin is large and interests are diverse. The Netherlands government, which controls the industry in the Dutch Indies, and the North American and Bolivian interests would complicate the problem. One group in London strongly advocates the formation of a cartel, but another is equally emphatic in opposition. The *Mining Magazine* for December, 1927, summarizes the attitude of the opposition in the following words:

"The majority of producers would not be willing to consent to such a scheme, any more than they were on two previous occasions when similar suggestions were put forward. He [W. R. H. Chappel, chairman of a group of important tin-mining companies] points out that the limitation of output would have the effect of adding to operating costs, upsetting the staffs and labor by putting them on short time, and of keeping the recent modern expensive plants running only part of the time for which they were calculated. Similarly, holding the output in reserve would disorganize all present financial arrangements by withholding revenue and profits, and it would also impose the drawbacks experienced by the producers during the days of the Bandoeng Pool whenever it became known that there was an accumulation of tin ready to come on the market. Finally, Mr. Chappel definitely stated that as chairman of companies of his group he would not agree to any plan that would tend to create an artificial position for the metal and interfere with a system of working which had been so satisfactory to shareholders and all others associated with the group."

Since the effectiveness of such an organization would hinge upon obtaining the active co-operation of the producers of 90 per cent or more of the world's output, it seems unlikely that a cartel will be formed, at least within a couple of years. Doubtless contemplation of the unhappy consequences of the Stevenson plan for controlling the rubber market tends to dampen the ardor for a similar venture in tin.

Assuming, then, that no artificial control is attempted, a number of factors may be enumerated that have a bearing on the trend of the market price.

Favorable Factors

(*a*) Exhaustion of some producing fields.
(*b*) Probable increased requirements of European industry.
(*c*) Probable increased requirements for American automobile industry.
(*d*) Possible increased requirements of tin-plate industry in America.
(*e*) Comparatively low level of visible supplies. (See Fig. 5.)
(*f*) Stimulation of use because of lower prices.

Unfavorable Factors

(*g*) Continued increase in Malay output as a consequence of large number of newly built dredges of modern design.
(*h*) Low production costs of most of the producers which leave excellent profits with the market at 45c. or even considerably lower.
(*i*) Probable increase in Nigerian output.
(*j*) Present abnormal accumulation of stocks in hands of smelters.
(*k*) Possible substitution in the United States of a synthetic resin lacquer for tin to coat sheet-iron food containers.
(*l*) Increased recovery of tin from the salvage of scrap and dross in the United States.

In connection with (*b*) it is significant that, whereas since 1913 consumption in the United States has in-

creased roughly 50 per cent, there has been no corresponding increase in Europe. (See Fig. 4.) A rather puzzling situation is indicated by the black square in the column for 1927. Taking into account the world production, and deliveries in the United States and Great Britain—both of which are presumed to be accurate—and the fact that so-called visible supplies declined several hundred tons during 1927, there is an apparent deficit of about 12,500 tons in the world balance on the basis of

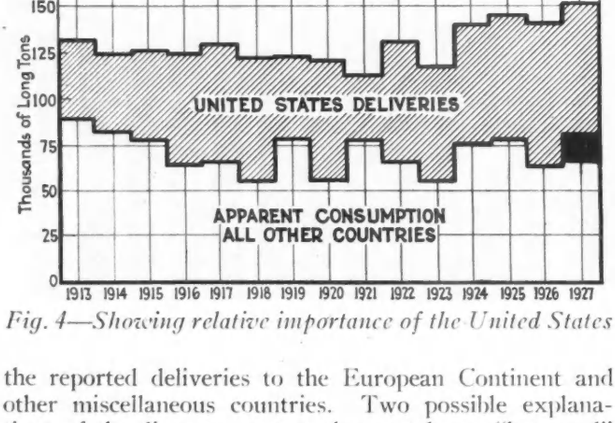


Fig. 4—Showing relative importance of the United States

the reported deliveries to the European Continent and other miscellaneous countries. Two possible explanations of the discrepancy are: that metal was "bypassed" into Continental consumption without getting in to the statistics, or that stocks at smelting plants in various countries have expanded to an abnormal degree. Probably both of these contribute to the reconciliation of the figures. It is contended by some that consumers in Continental countries have accumulated stocks because they thought the price was low. If that be the fact, the effect might be to decrease requirements for the coming year. However, definite revival of tin-consuming industrial activity in Europe should develop eventually, and the time may be at hand.

"World visible supply" is a term applied to tin afloat and in official warehouses in the United States and European ports. It takes no account of metal in the hands of smelting companies or of consumers, and really has less significance than is credited to it by dealers and speculators in London. However, that the current figures are comparatively low is a favorable rather than unfavorable factor, making for a strong market.

When tin prices are high the producers contend that the cost of tin in any finished article is so small a factor in the selling price that there is little tendency to find substitutes. If this were true it might be argued that lower prices would not stimulate use. Nevertheless, there is doubtless merit to statement (*f*).

Considering next the unfavorable factors: probably the most important are (*g*) and (*h*). Early in 1926 there were reported to be 40 dredges in operation in the Malay States. Late in 1927, according to a survey made by the firm of Messrs. Osborne & Chappel, "46 were in full commission, while a further 34 are to be in operation before the end of 1928." According to *Commerce Monthly*, 54 were reported recently to be in operation, 32 under construction, and 27 others projected.

Authorities agree that new capital invested in the tin-mining industry, principally on new dredging projects, during 1927 totaled about $40,000,000. In addition, about $14,000,000 was provided for financing the Perak Hydraulic Power Company, which will supply hydro-electric power for mining in Malaya. Similar large outlays were made in 1925 and 1926. Many of the dredges are giants designed to work banks ranging up to 120 ft. in height. The machinery for recovering the tin concentrate effectively is the best that engineers have yet devised.

Indicative of the situation are the following excerpts from the remarks of the chairman of Tin Selection Trust, Ltd., an important holding company having an interest in 50 different Malayan and Nigerian tin-mining companies:

"Three of the group companies in the East—namely, Northern Tavoy, Kampar Malaya, and Talerng, in all of which we have substantial holdings—should be producing before we meet again; indeed, the first dredge at Northern Tavoy is due to start up within the course of the next few weeks. The Kampar dredge, which is to be a mammoth plant of exceptional strength, embodying all the latest approved mechanical principles in scientific dredge construction, is, we are told, making excellent progress, and notable additions to the Talerng property foreshadow an early decision in regard to the provision of a second dredge. Toyo, the youngest member of the Anglo-Oriental group, is already in the list of producers, and should gradually work up to an output of 60 or 70 tons per month. Two other young companies, Sungei Kinta and Teja Malaya, have recently begun active operations, and it is satisfactory to note that the new dredge installed by Southern Perak, in which company we now have an important interest, is beginning to add substantially to the returns from that property. . . . The recently concluded arrangements with the Alluvial Tin Malaya interests imply not merely the control of a large and steadily increasing output and of many proved tin-bearing properties in Malaya."

To arrive at some tangible conception of the importance of this expansion, suppose that there were in 1928 a net gain of only 25 producing dredges over the 46 operating in November, 1927. If these average a monthly output of 40 tons of tin the increase in output would be 12,000 tons.

The question arises as to what extent a drop in price to between 40 and 50c. would defer the starting of newly completed dredges or cause present operations to be suspended. No answer to this can be given with assurance; but an important consideration in analyzing the question is the cost of production. The average in recent years is estimated to be something less than 35c. per pound of tin. Evidence of the wide spread between production costs and the market price in recent years is the large dividends paid by most of the companies. Earnings of 50 per cent per annum on the invested capital are not unusual, and dividends have ranged from 15 to 75 per cent annually. Further convincing evidence on this point is contained in the address of the chairman of Tin Selection Trust, already alluded to. After reviewing the entire position, the speaker elicited great applause from the shareholders by saying, "The operating companies in which we are interested can earn substantial dividends with the price of tin at its present figure." The price at that time was about 55c. As the Trust, as I have said, is interested in 50 different companies, and as it is hardly to be expected that all of its selections have turned out much better than the average, it is fair to assume that the statement reflects, in general, the position of the industry in Malaya and Nigeria.

No one begrudges the companies excellent earnings, nor the shareholders fat dividends; but the point at issue

is how low the price of tin can go without squeezing income to the point at which it is deemed more profitable to shut down dredges or curtail production than to produce at normal maximum capacity. There are of course marginal producers, whose costs are above the average; but the proportion of the Malayan dredge output that costs more than 40c. per pound is not important.

Consideration must also be given to the operations of the Chinese, who, it is estimated, contribute about 45 per cent of the Malayan production, by so-called "hand" mining. It is argued in some quarters that lower prices will cause a decided shrinkage in output from this source. On the other hand, consider the following view of the situation: The miners are there on the ground; their position is like that of a farmer with a single "money" crop. They are not particularly concerned with conserving the world's supply of tin nor with the depleting of their own ore reserve. They are sure of a market at some price for all the concentrate they can produce; if they work harder than they have been working they can produce more tin, thereby offsetting the effects of lower prices and still maintain their income. Perhaps the cost of production is high; but labor is the one big item in the cost, and if no other means of earning a living is at hand the average Chinese is likely to dig tin for whatever he can get. Incidentally, there has been a trend toward the purchase of large modern gravel pumps among the Chinese, so that it is probable that many of them can produce more cheaply than ever before. To conclude that a decline in the price, say, to 40c. would seriously affect Chinese production appears to be unwarranted.

What of the situation in Bolivia and the Dutch East Indies, respectively the second and third most important contributors to the world output? In Bolivia most of the production is from lode mines. Operations during the last two years have been reorganized from both a technical and economic standpoint, and production in 1927 showed an increase of 1,700 long tons compared with

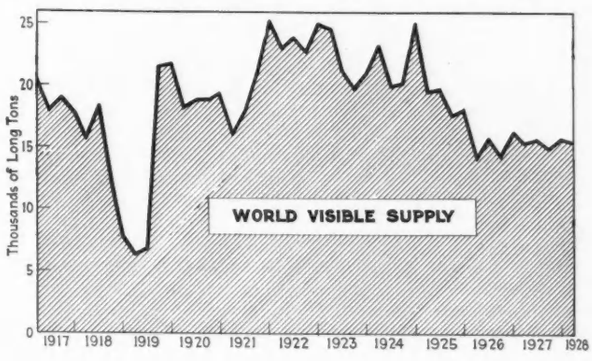


Fig. 5—Showing the decline in the "visible supply" of tin in recent years

1926. Further moderate increases of consequence are not considered improbable. Patiño Mines & Enterprises, the big factor in the Bolivian tin industry, reports for 1927 a net profit before depreciation and depletion of £1,481,813, equivalent to nearly 30c. per pound on a production of 25,000,000 lb.

The report of the general manager says: "Included in operating costs for 1927 are large expenditures in connection with the rehabilitation of the corporation's property that cannot properly be charged to capital account. . . . It seems likely that a similar procedure must be followed, during, at least, 1928 in order to modernize the property and generally prepare for the economic handling of greatly increased tonnages. With time, materially lower operating costs will result from these heavy yet necessary expenditures." No good reason appears to expect that some further decline in the price would cause a curtailment of appreciable proportions in Bolivian output.

In the Dutch Indies the tin mines, controlled by the government, are regarded as a dependable and steady

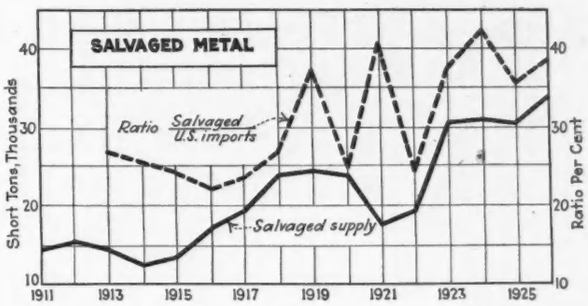


Fig. 6—Showing increase in supply of salvaged tin

source of state revenue. The policy has been to sell less metal on market declines, but it is understood that production is regular. No radical change is anticipated from this direction.

Apropos of the substitution of an organic substance for tin in the coating for sheet-iron food containers, it may not be generally known that one of the largest and most conservative companies in the United States has demonstrated by actual experiments in canneries that a product which it has developed can replace tin at a considerable saving in cost. The raw materials are inexpensive byproducts; the substance itself is a synthetic resin lacquer called glyptal. My information is that, with the possible exception of packers of pears, canners are convinced that glyptal is a success. Of the total consumption of tin in the United States about 30 per cent goes into the manufacture of tin plate. To what extent the new product will displace tin remains to be seen. At any rate, tin at 70c. per pound would find stronger competition than tin at 40 to 50c.

One other factor that should not be ignored in appraising the situation is growth in the industry of salvaging tin from scrap and other secondary sources. The trend in this direction is shown in the accompanying graph, Fig. 6. In 1926 the latest year for which statistics are available, 33,000 tons of tin, equivalent to 38 per cent of the imports of virgin metal, was recovered in the United States from salvaged sources. This compares with only about 24,000 tons annually in the period from 1918 to 1920. Part of the metal thus recovered is an electrolytic product of 99.75 per cent purity.

If it be assumed that the rate of consumption will increase only moderately, if at all, in the next two years; that Bolivia and the Dutch Indies will contribute approximately the same tonnage as recently; and that increased production in Nigeria will make up for possible declines in the countries producing less important quantities—one confesses that the event may prove some of these assumptions to be wrong—the factor that looms as most important is the rate of production in Malaya. If it increases to the extent that seems assured, 45c. ought during the next two years to be a good guess for the average price of tin.

The Flowery Mine and Mill at Virginia City, Nevada

A Dividend-Paying Property Owned and Operated Jointly by a Mining Engineer and the Prospectors Who Discovered the Mine

By JAY A. CARPENTER
Professor of Mining, Mackay School of Mines, University of Nevada, Reno, Nev.

THE FLOWERY mine is in the old Flowery district below Virginia City, Nev., in Six Mile Canyon. This district was well prospected, and many ledges were worked during the prosperous days of the Comstock. Tom and William Berry were raised in this neighborhood, first gaining experience with their father, then mining and leasing for themselves, and becoming keen prospectors with an abiding faith in the hidden possibilities of their own familiar hills.

In 1918, by careful panning of placer gold in the gulch close to the old Pet mine, a silver producer of the seventies, they discovered the source of the gold in a quartz outcrop on the hillside a little higher up and on the opposite side of the gulch. By good fortune the outcrop was on an open fraction between patented lode claims. Being accustomed to making a living by the extraction of ore rather than by selling claims, the brothers first sunk a 60-ft. shaft and then drove a 300-ft. tunnel, making the property pay its own way by sending ore to the value of $40,000 to custom mills and developing a worth-while body of milling ore that attracted the attention of the Comstock Merger Company. This company, working under a lease and bond, drove a lower tunnel, and by crosscuts, raises, and drifts fairly well delineated the orebody as being above the tunnel level and too limited in extent for the contemplated scale of operations and purchase terms.

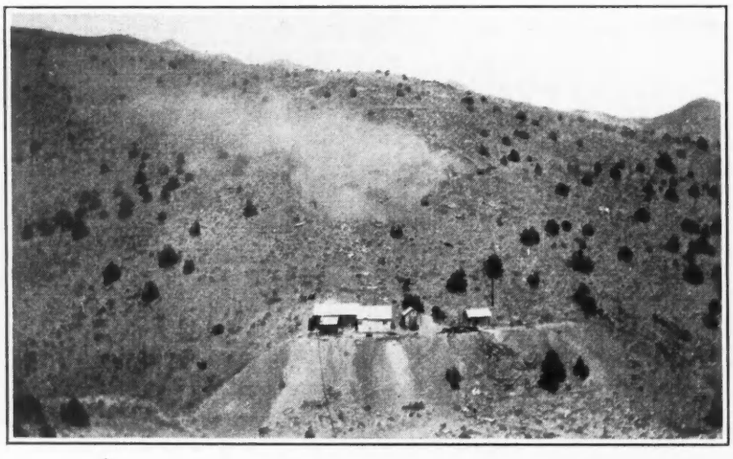
Development work disclosed a well-defined lode of altered andesitic rock, mineralized by a network of gold-bearing quartz stringers, this lode having a N 50 deg. E strike and 70 deg. dip to the southeast, and an approximate width of more than 100 ft. Sections of this width of higher mineralization offered a goodly tonnage of $5 to $10 gold ore, but the total width between walls, considered as a whole, was not of sufficient gold content to interest mining capital. In addition, the surface outcrop of the lode to about 30 ft. in depth carried too small a gold content to be considered anything but waste.

With this orebody developed, the Berry brothers in 1924 offered Roy A. Hardy and Alex Wise an equal interest in the property if they would finance a 100-ton mill and devote their time to the property. Accepting the offer, these two mining engineers made an excellent construction and operating record, and paid back the cost of the mill and mine construction by operating on a 120-ton-a-day basis, mining the sections of better-grade ore by shrinkage stopes and milling by cyaniding an all-slime product.

There was a possibility of greatly extending the apparently limited life of the mine by changing to a glory-hole system and mining and milling a larger daily tonnage of low-grade ore. This meant the removal of up to 30 ft. of overburden over the width of possible ore of over 100 ft., or about one ton of waste for three tons of ore, with the ore having an estimated value of only $3 a ton.

Mr. Wise and the Berrys purchased, for the company, Mr. Hardy's interest early in 1926 and undertook the removal of the overlying waste by carrying several raises through to the surface, using them in turn as mill holes in which to strip the waste and then as ore passes. In time the tops of these mill holes merged into a large glory hole as shown in the illustrations. The removal of this waste entailed operating the mine for many months on a close margin, with a steady expenditure at the same time for more equipment to bring mine and mill to the necessary tonnage to secure low operating costs. That this was

Surface plant of Flowery mine, showing glory hole in rear of mine buildings, after blasting boulders



done without appealing to the public or to mining capital for funds is a tribute to these men who, because of their pluck and perseverance, have cause to be proud of their present scale of operations, which are as follows:

The mine is now opened as a glory hole approximately 225 ft. long, 140 ft. wide, and 100 ft. deep. The drilling is done by jackhammers, followed by careful blockholing of the blasted ore on top of the filled raises, in order to avoid any delay in loading from the chutes below. The ore is trammed 1,000 ft. to the mill by electric trolley in 60-cu.ft. side-dump "U" cars. The same equipment trams the waste to the waste dump in the gulch between the mine and the mill.

The financial statement for 1927 gives the tons milled during the 10½ months of operation as 57,400 and the tons of waste trammed as 25,220, at a direct cost of about 40c. per ton of ore and waste. This amounts to 61c. per ton of ore milled, thus charging the mining of the waste to the ore as development work.

Interior view of glory hole

At the mill, the crushing units consist of a 14x36-in. Cedar Rapids type jaw crusher, feeding directly through a set of 14x28-in. rolls to a belt conveyor as a ½-in. product, and then through a redwood tank ore bin to the grinding units.

The original capacity of the mill, of about 125 tons per day, has been stepped up to 200 tons per day by a few changes in equipment and a clever arrangement of the flow sheet.

A 6x5-ft. ball mill was substituted for the original 5x5-ft. unit, and an additional classifier was purchased. The ball mill is in closed circuit with a Dorr classifier, but a second classifier now takes the first classifier's overflow and reclassifies it, delivering the plus-40-mesh material to the tube-mill circuit and the minus-40-mesh product to a Dorr thickener, whence it goes directly to

T. Berry and A. Wise, showing old stope encountered in glory hole

the No. 3 or last unit in the continuous series of Devereux agitators.

The 5x22-ft. tube mill in closed circuit with a third Dorr classifier receives less than one-half of the daily tonnage, grinding to a product such that 12 per cent will remain on a 100-mesh screen and 56 per cent will pass a 200-mesh screen, which is almost the same fineness as the overflow to the thickeners from the ball-mill circuit. This tube-mill product goes to a Dorr thickener and thence through No. 1 and No. 2 agitators, whence the combined ball- and tube-mill classifier slimed product goes to two 12x16-ft. Oliver filters, in series, with a pulping agitator between. At times the No. 2 agitator pulp is bypassed directly to the filter if it pans less colors than the No. 3 agitator.

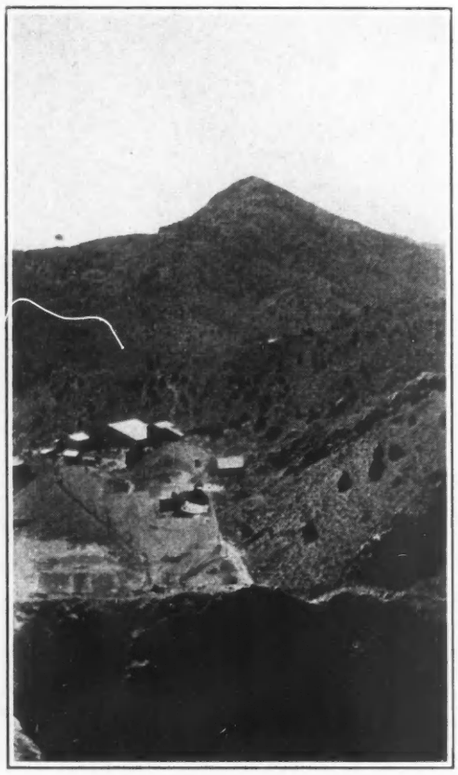
This unusual step of double classification and of bypassing a half of the product almost directly from the ball mill to the filter was based on careful observation of the fact that at a 40-mesh separation the overflow contained mostly the barren country rock, whereas the gold-bearing quartz dropped into the tube-mill hopper. This quartz is not released from the tube-mill circuit until its contained gold is well released from the quartz. The presence of coarse gold in the ore is shown by the high value of the pulp in this circuit.

The tonnage to the tube-mill circuit, about 50 per cent of the total tonnage, contains about 90 per cent of the total gold and silver. This richer material, in addition to the extra time in the tube-mill circuit, receives over five times the agitator treatment, getting in all over three days' agitation. This time factor appears necessary for the slow dissolving of the coarser free gold particles in the slimed pulp, and not for gold in the pyrite, which is barren.

By careful control of pulp density and maintenance of

equipment the Oliver filters handle one-third of a ton of slimed ore per day per square foot of surface area, with a low dissolved loss, due to the excellent leaching rate resulting from the coarse material in the ½ to ⅝-in. cake.

Precipitation of solutions is by the Mills-Crowe process of press clarification and de-oxygenation of the



Waste dump and mill from glory hole

solution, followed by the addition of zinc dust in a small 9x7-ft. redwood agitating tank containing a nest of six filtering leaves, each 3x3-ft., through which the barren solution is drawn off.

When the precipitate reaches about a $\frac{3}{16}$-in. cake the leaves are lifted out, subjected to dry vacuum and then to compressed air for discharge. The dried precipitate is melted in a tilting oil furnace. A $5,000 bar, 500 fine in gold and 350 in silver, has been delivered still hot to the U. S. Mint at Carson City four hours from the time of starting the clean-up.

The bottom of the tank is cleaned up only once in three months, yielding but a small percentage of the bullion. In operation, the effective but quiet agitation in the tank and the vacuum in the leaves maintain, judging from the excellent precipitation results, as uniform a coat of zinc dust and precipitate on the canvas as with filter presses and pressure pumps. The leaves are of burlap over wood slats incased in a bag of house-lining muslin. These bags cost only a dollar apiece and are renewed once in four months.

The striking simplicity of equipment and operation of this method of zinc precipitation, with its small floor area and large factor of reliability, marks it as an advanced step in precipitation of cyanide solutions. This was the first gold cyanide mill to adopt it. The idea was that of the Merrill Company, and it was placed in the hands of a mill operator with the necessary skill and perseverance to carry it out, as Mr. Wise received part of his training with that company.

To clarify the increased solution for precipitation, amounting to four tons per ton of ore, a Hardinge superthickener was placed ahead of the clarifying press, but as yet no bed of sand has been found that will maintain excellent results over a sufficient length of time.

The strength of solution used in the agitators since the mill started has been around 1 lb. sodium cyanide and 1.8 lb. protective lime, with a consumption of 0.17 lb. cyanide and 20 lb. lime. With the change in the flow sheet, the solution strength in cyanide and protective alkali have been held at only 0.3 lb. each. With this low strength of alkali and cyanide, and with the shorter contact of the colloidal slimes with the solution, the lime consumption has dropped to 5 lb. per ton of ore and the cyanide consumption has decreased slightly.

Consumption of power for milling is about 17 kw.-hr. per ton of ore. The tonnage milled for the number of simple standard units used in the mill keeps the total labor for operation and repairs to under 50c. a ton. Supplies are about 60c. a ton, giving a total direct milling cost of $1.45 in 1927, treating on an average of 180 tons a day, with an extraction of 95 per cent of the gold.

The amount of the assaying at the mine and mill is

William Berry at electric trolley control

very low, being limited to five solution samples and three filter samples, because of the combination of circumstances of mine or mill pulp samples that disclose their relative content on panning, by the number of colors discernible under a glass, and by the skill of Tom Berry in panning and estimating. In a few minutes he reports pulp values over the mill, which have checked so closely with fire assays as to replace them. He follows the same method on the mine samples to determine if the gold content is high enough for the mill. This method has

in its favor simplicity and rapidity, and its accuracy is based upon the hand and eye of a prospector as trained to their work with a horn as those of a frontiersman to the use of his rifle.

Company Policy

The policy of the company, though working a low-grade ore at a close margin of profit, is that of liberal pay to both day labor and salary men. In addition, the men are provided with free transportation to and from their homes in Virginia City. The mill has been closed down from one to two months each winter to avoid a heating installation and its cost of operation. As a consequence, the general expense above direct costs for the year was 30c. a ton, giving a total operating cost of $2.37. This figure does not include depreciation, but it contains about 17c. in improvements. The bullion returns for the year amounted to $2.99 per ton of ore milled, leaving a gross operating profit of over $35,000 for the year, from which a $20,000 dividend has been paid.

In handling overburden, the dividing line between waste and ore is placed around $2 a ton, and it has taken courage to run for a month or two on this lower-grade material in order to clear the way for better ore. During one such period of low-grade heads, Mr. Wise, prompted by Tom Berry's pannings of the surface and an old tunnel, undertook the development and purchase of ground diagonally across the gulch, known as the Lady Bryan.

A crosscut adit, driven at the level of the transportation line to the mill, cut ore of milling grade for over 100 ft. in width. Raises to the surface disclosed the fact that this orebody also extended to about 30 ft. of the surface. When the last of the overburden was removed from the Flowery glory hole, the task of removing the waste above the new orebody was started.

The Flowery glory hole will yield a total of over 200,000 tons, with a probable extension of ore under a heavy overburden requiring another method of mining. The Lady Bryan now promises a glory hole of equal size, with the added advantage of an undetermined tonnage below the tunnel level. Within a stone's throw of this new orebody is the old glory hole of the Pet silver mine, worked in the seventies and its unsuccessful shaft used to explore the territory below that glory hole. It is an excellent example of the revival of an old district, and demonstrates the fact that the old-timer occasionally encountered material that has only recently yielded to successful exploitation.

Problems of the Lady Bryan Ore

The Lady Bryan ore near the surface contains more colloidal slime than does the Flowery ore. The problem presented itself of whether or not to mill or tram to waste a large tonnage of protore of poor settling qualities. The answer was to run during the month of December on this ore, crushing in the ball mill, in water, and running the second classifier discharge to waste instead of to agitator No. 3. On its way out of the mill it is passed over a Wilfley table to take out a small tonnage of fine sand for return to the tube mill. This reject from the mill of one-half its feed assayed 25c. a ton, whereas the half that was cyanided was brought up to a good mill grade and received a longer treatment. Being a purer quartz product, the chemical consumption of lime and cyanide was lessened somewhat in spite of the necessary loss of solution. The net result was a 90 per cent total extraction, with recovery of $1.56 a ton in bullion from 6,000 tons of mill feed, at a direct cost of only $1.52 per ton, with the removal also of 3,000 tons of overburden to the mine dump. This indicates the possibility of increasing the milling capacity above 200 tons a day on the $3 ore by perfecting the classification of the classifier overflow to waste, by the addition of sliming tables, a centrifugal concentrator, or other devices, thus shunting out of the mill the light colloidal slime that takes needless room in the cyanide plant, giving endless trouble and consuming chemicals. Thus the work of the mill metallurgist is never done if he has the ingenuity to meet the varying mine conditions.

The Flowery mine, though relatively a small mine and bullion producer, is deserving of attention as an illustration of what can be done at mines too small for large company operations, yet capable of producing profitably under the independent mining engineer having the necessary vision, technique, and energy to accomplish results.

Economic Study of Utilization of Greensand

VARIOUS attempts have been made to utilize greensand for the production of potash, and most of them have met with failure, according to the U. S. Department of Commerce. Many processes have been invented for the extraction of the potash, and though successful operation has been attained on a laboratory scale, commercial operation is more difficult. Because of the low percentage of potash present in greensand (6 to 7 per cent), it is probable that successful utilization can be accomplished only where byproducts can be profitably marketed. The two outstanding processes are treatment with milk of lime, and acid leaching. A survey has been undertaken by the Bureau of Mines to determine the quality and quantity of byproducts resulting from treatment by these methods, the cost of production, market demands for the byproducts, prices to be expected, and freight rates to points of consumption. The object is to determine if the actual profit that may be expected from byproducts will be of sufficient magnitude to make potash extraction commercially successful. If this survey indicates probable success in any particular it will be followed by laboratory research.

Mineral Production of France

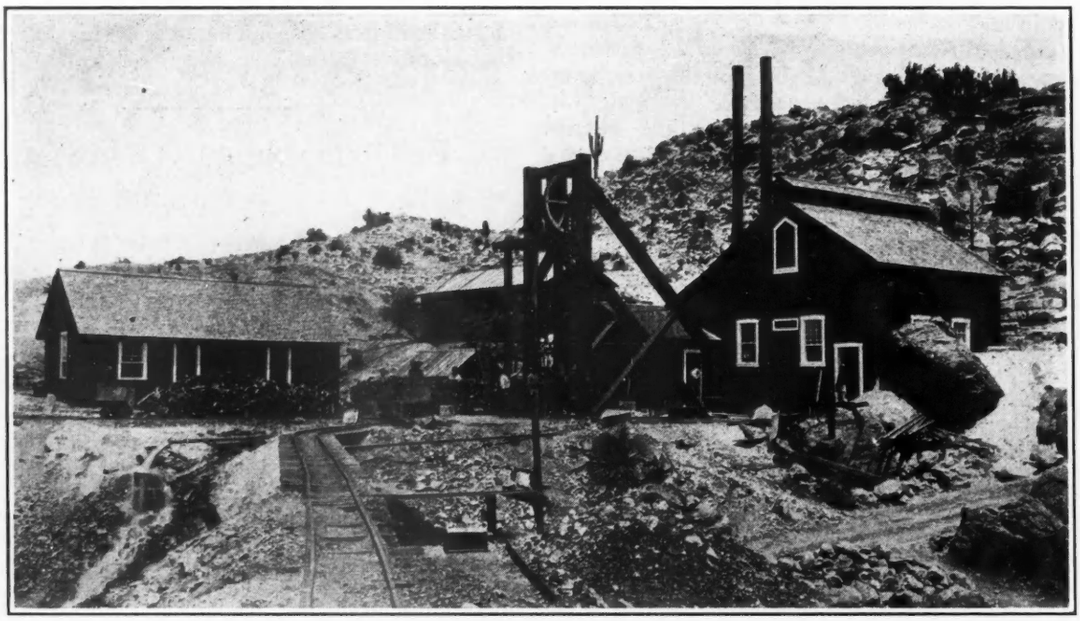
ACCORDING to figures recently released by the U. S. Department of Commerce, the estimated mineral production of France for 1927 compares with the 1926 production as follows:

	1926 Metric Tons	1927 Metric Tons
Bauxite	408,600	533,000
Antimony ore	2,900	3,100
Arsenic ore	49,900	51,200
Gold ore	69,300	69,000
Copper ore	9,600	50
Lead ore	16,000	26,000
Zinc ore	18,800	11,600
Zinc and lead ore	17,500	9,300
Manganese ore	2,625	2,400
Tin and wolfram ore	4,500	5,300

An increase in the production of bauxite is reported, much of which is exported, and of pyrites, although the total is still below domestic requirements. The great decrease in copper production resulted from the shutdown in 1926 of the principal producer. Antimony production is still small.

Early-Day Copper Mining in the Globe District in Arizona

Reminiscences of Prof. ARTHUR L. WALKER



Surface buildings near the Interloper shaft taken soon after the latter was sunk to the sixth level and underground development work started in 1889.

WHILE I was wandering around the mines at Globe and Miami last summer and heard the officials talk about the many thousand tons of ore in sight, I could not help remembering the conditions which obtained in the early times, when often we really did not know just where the next day's ore supply was coming from.

Ore in those days was material containing a very high percentage of copper, and bodies of that grade had a bad habit of petering out in a most unexpected fashion. We were fortunate, however, in always being able to keep ahead of the smelter requirements, but on some occasions we had a close shave. It was largely a matter of following the oreshoots and also driving to points where our intimate knowledge of the eccentricities of underground conditions enabled us to forecast quite accurately where ore should be; that ore was found when wanted is proved by the fact that since 1881, when the Globe mines first began to produce, work was suspended only when the copper-market conditions made it more profitable to save the ore underground than to extract it and produce copper at a loss or at a very small profit. The first suspension came in 1886, when, as a result of the failure of the Société de Méteau (in Paris), copper fell to 10c. per pound; and again in 1894 when copper reached 9c., and William Keyser, of Baltimore, then the president, decided to suspend operations until a more favorable situation developed.

In mining ore, careful sorting was necessary. The lowest grade of ore that could be smelted with a profit was determined, and all rock which contained less than the percentage of copper thus determined was sorted out in the mine and thrown to one side. All classes of ore were carefully assayed, and samples of these different ores labeled and sent to the mine office for the inspection of the ore samplers, so that they could readily recognize what should be thrown out and what should go to the smelter. This careful method of hand sorting naturally increased the cost of mining, but it was necessary to follow this practice in order that the grade of ore delivered to the smelter should be as high as possible; also, that no material would be smelted which would not pay.

Niles S. Berray, the capable and genial foreman of the mine (afterward superintendent), used to say, after we had extracted all the ore from a stope that could be smelted at a profit, that we would leave the workings, let the ore "grow" and then come back and take it out; meaning, of course, that we could later on afford to mine a lower-grade material.

The first part of this article appeared in the issue of April 14.

In those days the ground which is now being profitably mined and treated by the Miami and Inspiration companies was considered about as valuable as alkali dust.

The old smelting plant, part of the machinery for which, as has already been stated, was moved from the Miami flat, consisted of two 36-in. water-jacketed furnaces, to which a third was added later. Each furnace, when everything was running satisfactorily, would smelt about 40 tons of charge a day. The record for three months in 1883 and 1884 is shown in the following table:

	August, 1883	December, 1883	January, 1884
Ore smelted, lb.	2,747,000	3,482,000	4,297,000
Coke consumed, lb.	529,800	685,600	810,700
Copper produced, lb.	403,810	331,300	463,600
Furnace days	31	51	51
Ore smelted per day, lb.	88,600	68,270	83,970
Coke consumed to ore, per cent.	18.3	19.7	18.9
Copper produced to ore, per cent.	14.7	9.5	10.4

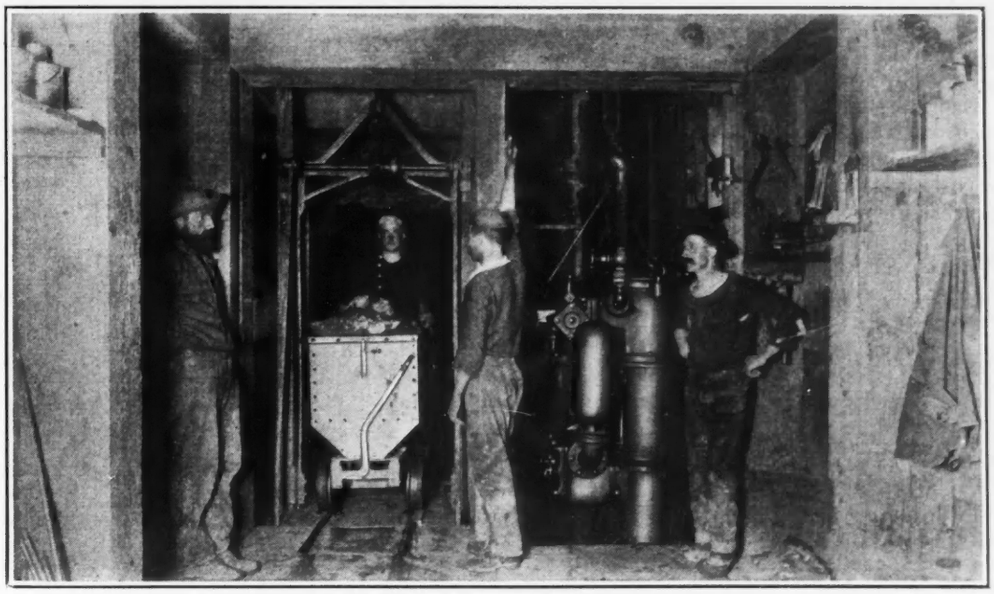
The question of building larger furnaces was discussed from time to time, but metallurgists and engineers were in doubt as to whether larger furnaces would give satisfactory results for smelting this class of ore; and in October, 1883, a letter from Rankin, Brayton & Company, manufacturers of mining and metallurgical machinery, stated definitely that, "furnaces larger than those designed to smelt thirty tons of ore a day would be most unsatisfactory," and that "instead of larger furnaces it was better to duplicate the 36-in. units."

This old smelter was operated for a period of nine years. A new smelter situated a quarter of a mile southeast of the old one was built in 1891 and blown in on Jan. 16, 1892. The new plant consisted of three 42-in. furnaces, having a total daily capacity of 185 tons of charge. Above each furnace and on the charge floor was placed a large hood or chamber, so that the velocity of the gases in passing through this chamber would be reduced to such an extent that the flue dust blown out of the furnace would fall out, collect along the sides of the chamber, and automatically flow back into the furnace. Fine flue dust in those days was a troublesome problem, and when blown out of the furnace covered the roofs of the buildings and the surrounding country. As this dust contained about 10 per cent copper, the loss was enormous. The enlarged dust chambers reduced this loss to a very great extent.

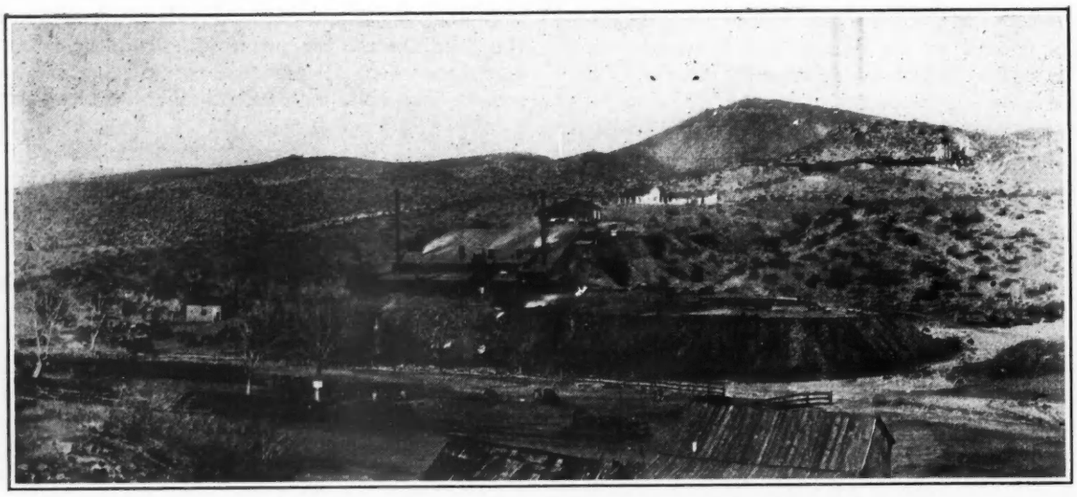
For the first time larger slag settlers were employed in order more satisfactorily to collect the copper entrained in the slag as it flowed from the furnace. The new smelting plant was connected with the mines by a Bleichert rope tramway, the first of this type to be installed in the Southwest. By this means the cost of conveying ore, which was more than 25c. per ton by wagon to the old plant, was cut to one-third.

Small and crude as this plant was when judged by modern standards, it was considered an ideal smelter at that time, and, according to James Colquhoun, then superintendent and afterward president of the Arizona Copper Company, its rating was very high when compared with the other smelting plants in Arizona.

The problem of coke consumption was an all-important one at the smelters in Arizona in the early days of the copper industry. Arizona Copper Company, at Clifton; Copper Queen, at Bisbee; and United Verde, at Jerome, had railroad connections or only a short wagon haul, and, although coke was an expensive item at the smelting plants of these companies, the cost was much less than it was at Globe. Coke delivered to the Old Dominion smelter had to be hauled by wagons from Bowie or Willcox, on the Southern Pacific Railway, a distance of 130 or 140 miles. Ox teams or mule teams were usually used; horses but seldom, as they could not stand the strain. The time required to make the round trip was from four weeks to four months, as in wet weather the wagons were frequently mired down to the hubs of the wheels and could not move for days. The wagon freight rate in 1883 was $36 per ton for coke hauled in from the railway and $15 a ton for copper hauled out. In 1890 the freight rate on coke was reduced to $29. The cost of coke delivered was from $50



Sixth level station at the Interloper shaft, showing the small pump at the right which was soon afterward replaced by a large, triple-expansion pumping engine installed in a pumping station on the left-hand side of the shaft.



The old smelter of the Old Dominion Copper Company (1889), situated about one mile northwest of Globe. The mines of the company were on the ground shown on the right-hand side. The old slag dump, containing thousands of tons of rich slag, which was afterward resmelted, can be seen in the middle of the photograph.

to $42 per ton. In addition to this the racking in the wagons and the many transfers to which the coke was subjected produced much fine stuff which could not be used effectively in the furnace and which increased the net cost materially. Under these conditions it was very evident that the best coke—that is, the strongest and having the lowest ash content—was the cheapest in the end, and coke from Pennsylvania and from Cardiff, England (shipped by steamer to San Francisco and then by rail to Arizona), was used most extensively. It cost less per unit of carbon available than the poor coke then produced in New Mexico or Colorado.

From the cost sheets shown (1888 to 1892), it will be seen that the cost for coke alone was nearly equal to the entire cost for all other operations, both mining and smelting. Efforts were made to keep the amount of coke used in the furnaces down to the lowest possible limit, regardless sometimes of a high copper content in the slag; with coke costing nearly 3c. per pound and copper produced at 6c. per pound it was good practice financially, if not metallurgically, to permit a larger amount of copper to pass off in the slag rather than add more flux and coke. The analysis of the composite slag sample for February, 1884, was: SiO_2, 30.1; FeO, 52.2; CaO, 2.0; MgO, 2.1; Al_2O_3, 9.1; Cu, 2.7 per cent. It was found that as the percentage of silica in the slag was increased the copper content also increased rapidly.

For example, 30 per cent silica gave about 1.8 per cent copper in the slag; 35 per cent, 2.8 per cent copper; and 40 per cent, 4 per cent copper. This copper in this slag was not lost, however. It was simply stored away (although we did not appreciate it at that time), to be worked over when the situation improved. The same condition obtained at Bisbee; at Clifton the slag from the Arizona Copper Company's smelter was granulated and run into the San Francisco River. We used to rather envy the manager at Clifton, who could granulate his slag and run it into the river, thereby avoiding the labor of handling slag to the dump. Later on, when it was found that the old slag dumps were a very valuable asset, and the copper stored in the slag produced by oxidized smelting could be readily recovered when added to a charge of sulphide ore, we felt that we were fortunate in having piled up this rich slag as a monument to what would now be considered poor metallurgy rather than have the slag distributed all the way from Arizona to the Gulf of California, as was the case with the slag produced by the Arizona Copper Company.

In regard to these old slag dumps, my dear old friend, Dr. James Douglas, said of the dump at Bisbee that, "while they never made a slag that ran over 2 per cent

The Old Dominion Copper Company—Cost Sheets

Mining	1888	1889	1890	1891	1892
Ore mined, tons	16,308	18,411	27,820	28,861	34,369
Development work, driven feet	2,503	1,951	(b)	5,877	5,285
Costs per ton ore					
Labor for extracting ore	$3.13	$2.98	$3.26	$3.72	$3.48
Labor for development work	1.27	.49	.74	.96	.70
Supplies	.54	.37	.37	.46	.35
Timber	.53	.39	.36	.46	.33
Wood (fuel for boilers)	.30	.24	.51	.47	.36
Hauling ore from mine	.36	.41	.36	.24	.....
Tramway	.....	.....	.....	.....	.09
Half of general expense	.25	.25	.17	.13	.14
Total cost per ton ore	$6.38	$5.13	$5.77	$6.44	$5.45
Limestone quarried, tons	None	4,163	7,910	8,595	8,843
Cost per ton, delivered	.....	(a)	$0.90	$0.85	$0.71
Smelting					
Ore smelted, tons	16,032	18,574	27,885	28,876	34,442
Limestone smelted, tons	.....	4,160	7,900	8,595	8,713
Total charge	16,032	22,734	35,785	37,471	43,155
Coke consumed, tons	2,304	3,046	5,239	5,283	5,897
Coke, per cent consumed to charge	14.3	13.39	14.64	14.1	13.6
Costs per ton charge					
Labor	$1.91	$1.65	$2.02	$2.05	(c) $1.55
Supplies	.15	.11	.09	.09	.09
Timber	.05	.04	.06	.04	.04
Wood (fire-fuel)	.36	.28	.35	.43	.26
Half of general expense	.26	.22	.18	.13	.13
Coke	6.93	6.37	7.83	8.44	7.73
Total cost per ton charge	$9.66	$8.67	$10.53	$11.18	$9.80
Copper bullion produced, lb.	4,633,160	5,915,510	7,720,015	7,273,126	8,019,059
Copper content of bullion, per cent	98.61	98.50	98.50	98.70	98.88
Cost per pound copper, cents	5.81	5.26	6.26	7.19	6.71
Copper produced to ore, per cent	14.4	15.7	13.70	12.40	11.48
Copper produced to charge, per cent	14.4	12.7	10.60	9.58	9.25
Copper in slag average, per cent	(b)	1.83	(b)	1.89	1.97
Cost of coke alone to other expenses, per cent	72	88	82	(d) 89	100

(a) No record. (b) Record missing. (c) Decreased cost due to economies effected in operating new smelting plant. (d) Due to lower costs for mining and smelting while cost of coke remained the same.

copper, for some strange reason when the same slag was resmelted they recovered more than 3 per cent of copper from the slag produced in the early days of smelting."

Of course it was uneconomical to use coal for generating steam. Wood was therefore used for this purpose, and cost $10 per cord, it being much cheaper than coal at $45 a ton. The wood was pine, oak, and mesquite, and was brought in from the hills on burros. Without these wonderful little animals it is doubtful if Arizona would ever have been settled.

Globe was on the frontier in every sense of the word, being within six miles of the Apache Indian Reservation, but in spite of the fact that it was in a wild and more or less lawless country the town was even then a model of law and order. There were many saloons and gambling places, and pay day, which came only once a month, was a lively event, but though some of the inhabitants and practically all visitors wore six-shooters, real shooting affairs were few and far between, and I doubt if as many people were killed or hurt by gun play in those days as there are now by automobiles. There was some excitement, however, as is indicated by the following extracts from my diary: "August 6, 1883—A certain amount of excitement was caused in the town due to the fact that a man who pulled out a revolver in a barroom quarrel let it fall and it went off, shooting him in the breast. The excitement was due not to the fact that a man was shot, but to the peculiar manner."

"August 11, 1883—The mail stage due from Casa Grande was held up on the bank of the Gila River near Riverside [in the vicinity of what is now Ray]; the messenger was killed, driver wounded and two thousand dollars consigned to the Pioneer mill taken off. This robbery is exactly similar to the one that occurred a year ago. At that time the robbers were caught and two lynched in Globe, being hung from a tree."

The sheriff led an easy life, and when dependent upon his fees had hard work to make a living. Of course, there were times when he was quite busy and when the sheriff's chair was not as comfortable as it might otherwise have been. One of these times occurred when a celebrated scout, Apache Kid, and nine other Indians (see accompanying photograph), were arrested for being implicated in the murder of Indians from another tribe. It was only a "shooting" quarrel, however, and the Indians were sentenced to imprisonment at Yuma. The sheriff decided that in view of the fact that they were to travel shackled and handcuffed he could easily convey them to prison with only one deputy. The stage carrying the Indians and their guards arrived at Riverside, on the Gila River, in the evening, and after supper they commenced to climb the grade from the river.

The prisoners were ordered to walk, the sheriff and his deputy, heavily armed, guarding them. Suddenly two of the Indians wheeled around and threw their handcuffed arms over the heads of the sheriff and his deputy, thus pinioning their arms to their sides, so that they could not move. Others jumped on them from behind and forced gags into their mouths, so that they could not shout (the stage having disappeared around a bend in the road the driver did not see what was taking place). While this was going on the remaining Indians broke the shackles and handcuffs on themselves by means of stones, took the weapons from the sheriff and his deputy, and shot them both. When the driver stopped to see what was the matter, one of the Indians ran ahead and fired at him; he dropped to the ground, slightly wounded. This driver, Lee Middleton, was an old Indian fighter, and played 'possum so perfectly that when the Indians came up they thought he was dead and left him without further injury. He told me this story himself. Kid and his party took the horses and escaped. Kid was never recaptured. It is stated that he led marauding Indians against isolated bands of whites, but so far as is known

Band of Apache Indians who were condemned to imprisonment at Yuma. They escaped while en route to the railroad in the manner described on this page. The clothes worn by the Indians were probably obtained while in prison awaiting trial.

he was never seen. Another rumor has it that only a few years ago he was still alive, living in Mexico, and made visits to the old Indian reservation to see his former wife.

I should like to record my appreciation of loyal support afforded me by the employees of the Old Dominion Company during the period I was there, 1883 to 1893, and especially of the assistance rendered me during the last six years of my stay when I was in charge of operations. I do not believe a finer body of men ever existed. The Anglo-Saxon race predominated, and included Cornish, Irish, and native Americans about equally divided, with a sprinkling from other nationalities in Europe. They were hardworking and intelligent and took a real interest in affairs. The wages were not high, especially when we consider what is paid at the present time. In 1883 the miners were paid $4 per day for ten hours' work. The smelter men were paid the same for either ten hours or eight hours, depending on the job. The next year they voluntarily, to a great extent, accepted a reduction to $3.50 a day, and that was the base wage for men in the mine and at the smelter for years. Roustabouts and some top men were paid $3 a day.

In the mine a large amount of work was on contract. Practically all development work was carried on in this way. Contracts were advertised, and the work was awarded to the lowest bidder. Owing to the fact that the character of the ground ahead was not known as well as it was later, surprises were encountered and sometimes the men made much more than the daily wage; sometimes less. If they made high wages nothing was said. They were encouraged to make as much as they could. If they encountered unexpectedly hard ground and barely made a living wage, they did not grumble, and I do not recollect a single case where the miners defaulted. As a result of this open contract system the men worked very hard and made on the average about 50 per cent more than the daily wage. The company, as a result of the energy of and intelligence shown by the men, saved money. In 1892, the average cost for development work for labor, not including supplies and timber, was: drifting, $2.35 per foot; crosscutting, $2.36.

It was a privilege to work with such a fine body of men and it is always a great pleasure to look back upon my associations with them. Everyone was as good as anyone else, but when it came to working and obeying orders, properly expressed, there was no questioning or dissatisfaction. The men themselves also realized with pride that each was one of an exceptionally fine group. Among those from this group who have made names for themselves might be mentioned the Hon. Geo. W. P. Hunt, now Governor of Arizona, serving his sixth term, a record not equaled, I believe, in any other state; George Wilson, a banker of prominence and president of several banks in Arizona, and others.

In closing, I wish to say a word about the character of the people in the West. I can only, however, add my testimony to what has already been stated many times—that nowhere in the world has there even been a more chivalrous people than those on the old frontier; their deference to women traveling through the country was such that a woman was much safer in the wilds than she would have been in Eastern cities. I remember once making a stage trip with Al Sieber, the celebrated Indian scout, and though the ride was a long one and the stage open, he would not smoke in the presence of a lady passenger. No prospector, miner, or cowboy ever turned the cold shoulder to one in need.

Dust Collection in a Granite Plant*

THE real problem of collecting most dust is the definite settling of the fine material gathered by the exhaust system. Coarse particles are easily removed by one of several methods—bag screens, cyclones, or by gravity—as they pass along the pipes or over settling chambers.

One method used for separating dust particles from an air current is to employ gravity and let the dust settle in a room or bin. A comparatively large room would allow the air to be passed through at a relatively low velocity and insure a high percentage of dust removal. However, as there are limits to the size of such a chamber, the air current passing through the exit pipe usually carries into the open air a comparatively large percentage of fine dust.

A second method also employs gravity. The weight of the dust particles is increased by moistening them with water from sprays. A difference of opinion exists as to the effectiveness of this method. The claim has been made that fine dust will pass through a spray of water. Another method is the cyclone system, but here again fine dust causes difficulties.

The Bureau of Industrial Hygiene of the New York State Department of Labor examined granite dust in four different kinds of arresters and found the percentage of fine dust to total dust as follows: Cyclone separator, 0.1; settling room, 4.3; 30-ft. wooden pipe, 25.5; bag separator, 49.9. This was not a conclusive test. Officials of the bureau familiar with many dust-collecting systems state that although the tests by no means prove that all bag separators are the best for fine dust, yet the indications given by the tests are in line with their experience, which favors the screen or bag method of capturing fine dust.

The most satisfactory method developed for eliminating is that of passing the dust-laden air through a series of screens. Important factors are slow velocity of the air and a very fine-mesh screen or bag. The necessary fan should be attached at the end of the system, pulling the air through and not driving it. The velocity recommended by the Bureau of Industrial Hygiene is 2 cu.ft. of air per minute against each square foot of screen area. Equipment for this work is manufactured by the following companies:

American Foundry Equipment Company, Mishawaka, Ind.
The Pangborn Corporation, Hagerstown, Md.
Dust Recovering & Conveying Company, Cleveland, Ohio
W. N. Sly Manufacturing Company, Cleveland, Ohio

The Pangborn company's equipment consists of cloth screens, and the dust which is removed by them drops by gravity to hoppers below. A vibrating device keeps the screens free from dust accumulations. The air leaves the outlet at the top of the equipment and is practically free of all dust. The equipment of the Dust Recovering & Conveying Company consists of a series of circular tubes made up of fine-mesh cloth or screening. Air is drawn through these and the dust deposited on the inside of the tubes. An automatic cleaning arrangement takes care of the removal of the dust and produces a supply of clean air.

During this study the bureau consulted granite workers, dust-eliminating equipment companies, state factory inspection officials, and literature on the subject, to get material on present approved practice in dust removal.

*From a report prepared by the Policyholders' Service Bureau, Metropolitan Life Insurance Company, New York.

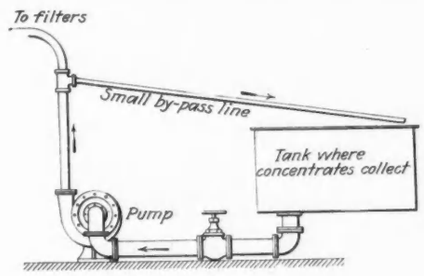
USEFUL OPERATING IDEAS

Improving Concentrate Pumping

By Charles Labbe

IDEA No. 1

TROUBLE was experienced in a flotation plant with pumps that lifted concentrate pulp from a collecting tank to filters. Concentrate settled and accumulated in the tank, at times partly choking the pumps' intake pipe and thus making pumping uncertain and difficult. The pump casings were connected to clear water pipes for washing out after pumping and for filling preliminary to the next start. For the agitation of the concentrate in the tank an air pipe was used, as well as a water hose to dilute and move most of the concentrate. However, pumping was far from satisfactory.



Arrangement of concentrate tank, pump, and bypass line

To remedy the difficulty a tee was installed with a 1-in. pipe in the 5-in. outlet pipe, extending to a point opposite to the intake pipe of the pumps; the bypass pipe is inclined as shown in the accompanying sketch; and, as it drains toward the tank, it cannot fill and choke. The supplementary circuit acts as an agitator for the concentrate and keeps it from accumulating at the back; the loss in pumping efficiency is compensated by better running and less labor.

Modifying Agitator Practice

IDEA No. 2

SUPPLEMENTING the article on the Midas cyanide plant in the March 31 issue of *Engineering and Mining Journal,* Milo Carlston writes as follows: "Effective operating changes have recently been made. It was found that mud banks formed on the sides of the agitator tanks just above the rakes, and occasionally a bank would slough off and stick the agitator. To avoid this trouble, a ¾-in. header pipe for compressed air was extended around the top of each agitator; and at the end of every 8-ft. length of pipe a reducing tee was put in; from this a ⅜-in. pipe was extended 12 ft. below the surface of the water. For a few minutes two or three times a day, compressed air is forced through the main 2-in. supply line, through the ¾-in. header pipe and thence through the ⅜-in. pipe, which has its outlet below the surface of the water, thus preventing mud banks and assisting agitation.

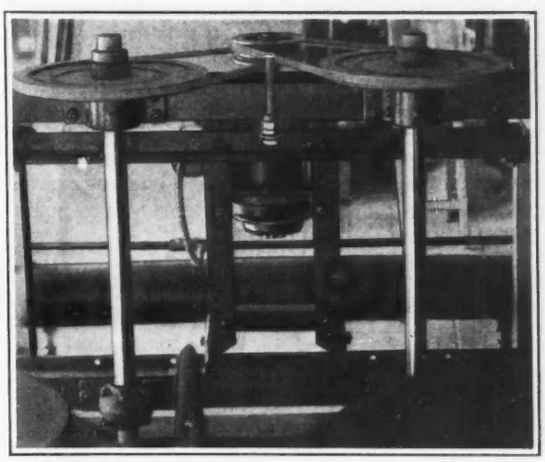
A hole was bored through the hollow shafting of the Dorr agitator just above the water line and a tee put in the air pipe which hangs from the Lunkenheimer swivel. From the tee a short pipe comes through the shafting, and on the end of this a long pipe hangs from an elbow to within a short distance of the rakes.

Part of the air which is forced through the Lunkenheimer swivel for the air lift goes through this tee and pipe to prevent mud islands from forming on the bottom of the agitator.

New Drive for M.-S. Cells

IDEA No. 3

A NEW TYPE of motor drive for M.-S. flotation cells has been installed at the Gold Hunter mill, near Mullen, Idaho. The changes in the mill and the new cells were designed by W. L. Zeigler, mill superintendent of the Hecla Mining Company. Each pair of cells is served by a 5-hp. motor, which drives the vertical shafts by single-strand "Tex ropes." The motor is a vertical type, supported by two angles as shown in the accompanying illustrations. The upper bearings of the spindles as well as the lower are supported by I-beams, which are placed flatwise and supported by filler blocks and bolts at intersections of the cell frames. All parts of the structure are especially rigid, and alignment is easily maintained. The spindles can be readily removed. A feature of the design is that it reduces maintenance to a minimum. The device is free from many operating troubles. On the whole the flotation machine



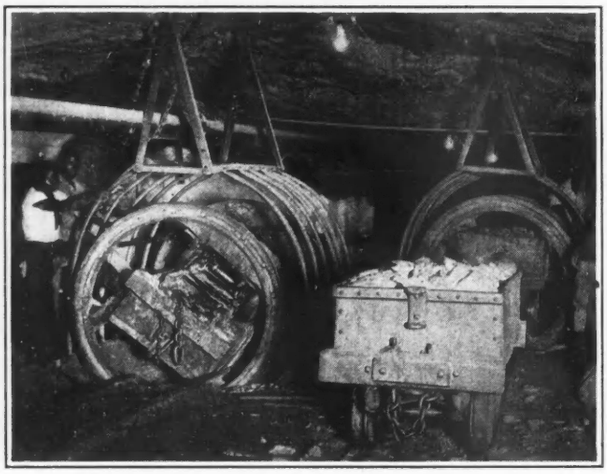
Single-strand "Tex-rope" drive linking M.-S. flotation cells and motor. The latter is partly concealed by the angles which support it.

is better lighted from above, and the frothing conditions can therefore be more readily observed. The load factor of the motor is close to its horsepower rating, and by the use of such machines the total load factor of the mill can be kept at a high percentage of total motor rating. The cells shown in the illustration were manufactured by the Cœur d'Alene Hardware & Foundry Company.

Guard for Car Dumper

IDEA No. 4

AT ONE of the gold mines of the Far East Rand, South Africa, a safety guard is placed over the car dumper in the shaft station to protect the men working about it. Two of these dumpers with guards are shown in the accompanying photograph. The guard is made of lengths of 2-in. pipe approximately 6 ft. long and flattened and punched at each end. The lower end of each length is bolted to an angle iron running horizontally along the top edge of the sloping side of the pocket on either side of the dumper. The pieces of pipe are curved as shown. Their upper ends are bolted to an iron strap suspended from the roof by the two triangular supports shown in the photograph. These supports are fabricated from angle iron. The bars of the guard are spaced about 8 in. apart horizontally.



A safety guard protects the workman employed about these dumpers

Getting a Blowpipe Bead Without a Platinum Wire

IDEA No. 5

A METHOD of obtaining a blowpipe bead without using a platinum wire is as follows: One end of a glass rod is heated in an alcohol flame and dipped into a mixture consisting of two parts by weight of powdered borax and one part of litharge. The borax and litharge should be mixed thoroughly. This end of the rod is then heated again, whereby an easily fusible bead of lead borate is formed. This is cooled off slightly, dipped into the substance to be examined, heated again, and, after higher fusion, cooled off. The bead will then show the characteristic color.

Treating Die Sand by Amalgamation at Mysore Gold Mine

IDEA No. 6

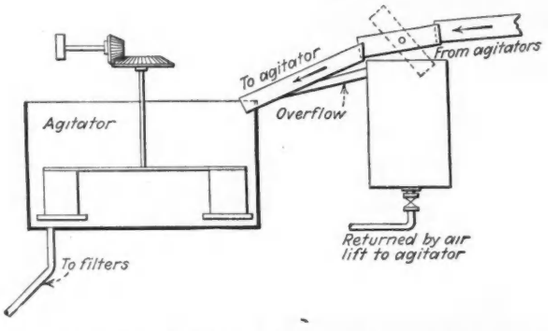
WORK on clean-up days at the Mysore gold mine, in India, includes the treatment of the die or coffer sand from the battery. The method of treatment is described by F. W. Kendall in a paper which is published in Bulletin No. 21 of the Kolar Goldfield Mining and Metallurgical Society and reprinted in *The Mining Magazine* for February. The details are as follows:

The die or coffer sand is treated in a clean-up barrel 3 ft. 3 in. long by 3 ft. 5 in. diameter, which is driven off the main line shafting at a speed of 28 r.p.m. Diorite pebbles are used for grinding and amalgamating in the barrel in preference to iron balls or old pieces of broken stem, which, in addition to being detrimental to amalgamation, are very troublesome to free from amalgam after they have become pitted. The barrel is revolved for about 24 hours, and is then discharged into a wooden, iron-lined hopper, having a baffle made of 2-in. square wooden strips; the gradual removal of these baffles feeds the charge to an amalgamated plate supplied with water. The charge is dealt with little by little, and the iron removed by screening and by means of magnets. The whole flows into a tank, which is eventually cleaned out, and the sand put through a battery.

Tonnage of Ore Pulp Is Estimated Accurately

IDEA No. 7

AT THE DOME MINES cyanide plant, in the Porcupine district of Ontario, the flow tonnage of pulp is measured at a point between the agitation tanks and the mechanically agitated storage tanks ahead of the filters. The accompanying sketch will illustrate the method employed. The launder carrying the pulp is provided with a swing section by means of which the flow may be deflected to a measuring tank. In the method illustrated, the time taken to fill this tank to the overflow is noted, and the tonnage calculated by reference to tables based on the capacity of the tank and the specific gravities of the ore and pulp. The tank is provided with an exit at the bottom, through which the pulp is discharged after the test and returned to the flow to the filters. A hose is provided for cleaning out after each test.



By diverting the flow of pulp at intervals into the small tank its tonnage may be estimated

COMMENT AND CRITICISM

The Nationality of Molybdenum

THE EDITOR:

Sir—Your article in the March 3 issue of *E. & M. J.* entitled "Molybdenum: An American Metal for Alloy Steel" awakens some thought. In the first place, it reminds us of our difficult position as a younger country in relation to the wonderful resources—natural, industrial, financial—of the American nation, which is favored with individual personal ability and initiative wherewith to exploit these resources to full advantage. Such superiority may well astound us and at times take the wind out of our sails, but in accepting all that as inevitable may I venture to suggest that a technical production in your journal should aim at a more impartial view than is conveyed by your article, which, I contend, is misleading to any one unfamiliar with the situation, indicating, as it does, that the world will have to depend on America for its entire supply of molybdenum because there is little or none in other countries. This is by no means a foregone conclusion.

It is true that for the last few years the United States production of molybdenum has put all other countries in the shade. But why call molybdenum "An American metal"? The United States owns the largest and most important known deposits of molybdenum in the world, and with enormous tonnage of ore reserves, although not high-grade, is setting the pace for production. But according to "The Mineral Industry," up to the end of 1926 America had contributed not more than 42 per cent of the world's production, more than half of which was produced in 1925 and 1926—(1927 is the record year for United States production, but world statistics are not yet available).

America's production of molybdenum practically started after the Great War, but this metal was used to advantage prior to 1918 and proved of great value during the war for armaments and other applications, being mostly obtained from Australia, Norway, and Canada. And now you tell us of a novelty—an American metal. We are accustomed to regard Americans as a privileged people living in God's country, but it comes rather as a surprise when you corral one of the elements out of our chemistry book and place geographical limits round it. The United States has fixed us with a tariff wall, but please do not give out information in a way which may make the world feel that minerals are going to stop occurring outside of this wall.

But to be serious, your article does not give the unbiased information that readers in different parts of the world should get from a technical journal of international repute. Imagine some one in a far-off land looking for information on molybdenum and reading your article. Would he gather that Australia, Norway, and Canada had produced substantial quantities and that together up to the end of 1926 they had produced more molybdenum than the United States, and that, even including 1927 in the total, other countries together had produced approximately as much molybdenum as America, in spite of the intensive efforts of recent years by that country to capture the world market? The monograph "Molybdenum" by Eardley Wilmot, published by the Department of Mines, Canada, gives an idea of the world's distribution of molybdenum ores (pages 165 and following) and the producing countries up to the year 1920. I am taking the liberty of mailing you a copy.

So much for the past. As to the future, this cannot be gaged accurately until some sense of proportion has been maintained relative to the efforts of the various countries to exploit this mineral. Up to the present no country has tackled the problem in the thorough manner the United States has; consequently, less is known in other countries as to their resources and potentialities.

In conclusion, one idea which is really behind my letter is this. A prominent reason why we are not producing some molybdenum in Canada at present is not because of the absence of that "American metal" in the dominion, but largely because of our relative position to you good people, whose ability to establish this industry at home for yourselves has acted as a deterrent to our own exploitation and development, although you have done so much to promote the use of molybdenum steels generally. But we are still trying, with every hope of success, and all we expect is a fair opportunity to get into the game.

H. H. CLAUDET.

Ottawa, Ontario, Canada

[Mr. Claudet has, it appears, misunderstood the purpose of the editorial to which he refers. It was not intended as a résumé on the molybdenum resources of the world but rather as an economic study of the position of the United States with regard to this metal. The suggestion was made that iron and steel users of this country might well give more attention to molybdenum as an alloying material, in view of its desirable properties and because ample supplies were available from domestic mines, making imports unnecessary, as is the case with other alloying materials.

It is surely not stretching a point to call molybdenum an American metal when latest statistics indicate that about 90 per cent of the world's production comes from the United States. Mr. Claudet would not object, we think, if we referred to nickel as a Canadian metal—an equally apposite designation.

The tariff wall that, it is intimated, has been built around molybdenum can hardly account for the status of the domestic industry. A large portion of the domestic output is shipped abroad, where it must compete with the molybdenum production of foreign countries, which, it is true, have been important sources of molybdenum in the past; but it would appear that the enormous resources in the United States, and the low cost of production attained by the development of modern technical methods, have insured dominance, for the time being at least. Without doubt, large deposits of molybdenum exists in Canada and other parts of the world. The United States seeks no monopoly in this metal, but the desire of the producers to get all the business they can is a natural one.—EDITOR.]

* * *

Fathers of Selective Flotation

THE EDITOR:

Sir—The editorial "Fathers of Selective Flotation" in your issue of Feb. 4, 1928, recalls the article by E. H. Robie entitled "Selective Lead-Zinc Flotation at Sunnyside," published in the issue of May 8, 1926. I remember that at that time I wished to take exception to the statement that "The Sunnyside mill, at Eureka, Colo., was the first in North America to practice selective flotation." In my opinion the first successful selective flotation on a commercial basis was done at Midvale, Utah, by Knox & Company when it was leasing the old United States dump in 1919 and 1920. This work was described fully by myself and William Fagergren in the *Mining & Scientific Press* of Sept. 25, 1920.

In justice to myself and others connected with those operations, I feel that these facts should go into the record. The early work at Sunnyside, in my opinion, should be considered in a different class, for the reason that it was not a "commercial" operation. Lead and zinc concentrates were made, but at the same time a middling assaying about

20 per cent each in lead and zinc was produced as a byproduct that could not be marketed. In contrast to this, Mr. Fagergren and I at Midvale made two concentrates and a tailing that assayed as low as 0.6 per cent lead and 1.8 per cent zinc. Not until a tailing is made can a process be properly called a "commercial" success.

Incidentally, a visit to our plant at Midvale by W. N. Rossberg, now general manager for the Clark interests in Butte, and G. A. Hellstrand, prompted the Timber Butte Milling Company to undertake seriously the development of the selective practice that has been so successful at Butte. W. D. GREEN,
Flotation Metallurgist, Combined Metals Reduction Company, Bauer, Utah.

* * *

The Qualifications of the Next President

THE EDITOR:

Sir—I would judge by the speed with which you rush to the defense of Mr. Herbert Hoover, anent "Mr. Hoover and the China Incident," in *E. & M. J.* of March 17, that this gentleman has been able to work the "rabbit's foot" successfully upon you too. You say: "History relates few instances of a great man escaping the envy, hatred and malice of a section of his contemporaries. Mr. Hoover's record of scholarly attainment, engineering achievement, administrative success, and humanitarian service has seemingly brought to light the innate meanness of character of those in whom initiative of the better kind is lacking, and whose judgment of their fellows is warped, possibly by an uncomfortable realization of their own incapacity and the smallness of their intellectual and moral stature"; and you close by saying: "The evidence merely confirms the oft-repeated statement that Mr. Hoover ranks among the greatest living Americans—great by virtue of an ability and zeal for achievement in many fields of endeavor."

These are rather strong statements, and should have some solid evidence to back them. To be specific, just what are the engineering achievements that stand to his credit? I don't mean those that he may have accomplished vicariously; but those which he initiated and carried to a successful conclusion. Also, what are his scholarly attainments? As throwing some light upon these questions, if you will take the trouble to read his address, "The Engineer's Contribution to Modern Life," as published in the March number of *Mining & Metallurgy*, I think you must conclude that on the evidence afforded here Mr. Hoover possesses none of the qualities you attribute to him. If a fifteen-year-old school boy could not write a better composition than this—superior in thought, logical arrangement, and clarity—he would not be entitled to a passing mark. Can you imagine a man like President Lowell of Harvard or Butler of Columbia signing his name to a composition of this kind? I cannot.

I think we will all agree that Mr. Hoover has been a very fortunate man. He long since discovered the value of self-advertising and the beneficial results that are apt to follow the employment of an active and efficient press agent, or perhaps several of them. Instead of following the old and well-worn path to political preferment by espousing the cause of an imaginary poor and downtrodden proletariat, he has varied his tune to that of a superman in the rôle of a business administrator and "go-getter" in the service of the government. A careful and unbiased analysis will show that Mr. Hoover is anything but a superman; and all this other fine stuff written about him has little basis in fact. It is probably safe to say that, among all the engineers in the United States, there are perhaps ten thousand fully as well equipped as he is to become President. Among this large number there must be some that are almost infinitely superior, so that if the question is that of "boosting" an engineer for the office, why not pick out the best? ROYAL P. JARVIS.

Sultepec, Est. de Mexico, Mexico.

[Dr. Jarvis's disagreement only throws into bolder relief the general verdict as to Mr. Hoover's record of accomplishment. Space forbids a comprehensive recital of facts; but, when Dr. Jarvis questions Mr. Hoover's scholarship, perhaps he is overlooking the fact that he was the co-translator from the Latin of Agricola's "De Re Metallica;" and the author of "Principles of Mining." Mr. Hoover's entire professional career has been one of well-deserved achievement, culminating in the presidency of the Institute and the recent award of the Saunders Medal, "in recognition of his distinguished contributions to the progress of mining engineering." To exemplify administrative success, the result of his untiring zeal and the application of engineering principles in the reorganization of the U. S. Department of Commerce will suffice. Any one who questions the sincerity of the tribute to his service in the great cause of humanity must have forgotten the war in Europe and its aftermath, and the part played by Mr. Hoover in the work of relief—EDITOR.]

* * *

World's Deepest Mine

THE EDITOR:

Sir—In your article "World's Deepest Mine in 1927," published in the Feb. 11 issue, you give first place to the No. 3 shaft of the Village Deep, and indicate that the relative position of the St. John del Rey and the City Deep is uncertain. I have no information as to whether the No. 4 shaft of the City Deep has been deepened beyond the 6,900 ft. which you state, but the St. John del Rey is now 200 ft. deeper than the figures you give, as the workings are down to the 7,126-ft. level. This makes it a close second to Village Deep, with its 7,264 ft., and as the next "horizon" of the St. John del Rey will be at 7,326 ft., it is not improbable that it will, during the next few years, regain the position it long held as the deepest mine in the world. THOMAS T. READ.

Scarsdale, N. Y., April 16, 1928.

Sodium Cyanide as a Deadener in Flotation

THE EDITOR:

Sir—May I ask you to publish a correction of an error in the annual review number of Jan. 21 on p. 117, where in the next to the last paragraph the statement was made that in the Utah Copper mill the copper flotation was deadened by the use of 0.5 lb. sodium sulphide per ton. This should have read 0.5 lb. of sodium cyanide.

CHARLES E. LOCKE.
Cambridge, Mass.

* * *

Naming the New Borax Mineral

THE EDITOR:

Sir—I have just opened my copy of the *Engineering and Mining Journal* for Feb. 11, and once more I notice an editorial on the borax industry, referring to the new deposits that are being mined in the Kramer district. Several times, I think, your journal has referred to this new mineral under the name of rasorite, which is of course all right, since that name is in use among those operating the property at Kramer. However, Dr. Schaller and I were the first to describe this material as a new mineral, and it is a fact that the name kernite was properly and appropriately given, and is of course now the accepted mineralogical name for this substance. Since I have never made reply to the letter of Leroy H. Palmer, published some months ago in your journal, it appears to me that there may still be some misunderstanding about the validity of the name kernite.

I think it is much more appropriate to use for a new mineral a name derived from the locality of the discovery of that mineral, as has been done by Dr. Schaller and myself in the present instance, than to name the mineral for some individual, unless, indeed, that name is one of outstanding attainment in connection with the subject, as in the case of Meyerhoffer, for whom we named the mineral meyerhofferite. Also, I should like to say that at the time of proposing the name kernite neither Dr. Schaller nor I knew that another name was then suggested. We naturally assumed that in due course a new name would be given by someone, and as Dr. Schaller and I both recognized the material as something new in our experience, and the actual identification was made by Dr. Schaller and the mineral described by him in the official journal of the Mineralogical Society, it was entirely appropriate that we should select the name as we did.

The matter of the name used is probably not important, but it seems to me that it would be as well to support the official name in your references, especially considering that the first announcement of the discovery of this mineral appeared in your own columns using the name kernite.

HOYT S. GALE.
Los Angeles, Calif.

Consultation

Quicksilver Ores and Their Treatment

"Will you be kind enough to furnish me with information regarding the latest type of furnace for the treatment of cinnabar ores? Also, please inform me if there is a textbook dealing with the occurrence, formation, and geology of quicksilver deposits?"

Recent practice in the metallurgy of quicksilver favors the use of the rotary furnace. The H. W. Gould Company, Mills Building, San Francisco, controls the patents covering the use of this apparatus for reducing quicksilver ores. In a recent circular distributed by that company, the claim is made that 90 per cent of the mercury produced in the United States is from ores reduced in rotary furnaces.

The rotary furnace may be of the single-drum, internally heated, or of the double-drum, externally heated, type. Single-drum installations are more common, probably because of lower first cost. The externally heated type has the advantage of simplification of condensation, and, it is claimed, higher net recoveries with lower operating costs. The probable life of the property is an important factor in this connection. Furnaces of the single-drum type are customarily assembled by lining cement kiln shells with firebrick, tapering slightly at the feed end, and with closely fitted seal rings at both feed and discharge ends. Condensation practice varies slightly, but the customary procedure is to draw the vapors into a large brick chamber, where the dust is settled, and then through vitrified tile-pipe condensers to the exhaust stack, through which draft control of the entire system is regulated. Under this arrangement, a clean-up of "quick" and soot is made at several points in the condensation system.

The following companies manufacture rotary kilns and will give detailed information:

Allis-Chalmers Manufacturing Company, Milwaukee, Wis.;
Gruendler Patent Crusher & Pulverizer Company, St. Louis, Mo.;
Kennedy-Van Saun Manufacturing & Engineering Corporation, 50 Church Street, New York, N. Y.;
The Hardinge Company, York, Pa.;
Traylor Engineering & Manufacturing Company, Allentown, Pa.;
Vulcan Iron Works, Wilkes-Barre, Pa.;
Worthington Pump & Machinery Corporation, 115 Broadway, New York, N. Y.

The rotary type furnace seems to have nearly completely superseded the old Scott or shaft-type furnace, which enjoyed great favor before the adoption of the mechanical and continuous-operation type. The Scott furnace is described in the publications listed below. One important advantage of the Scott furnace over the rotary furnace is its success in handling dusty ores.

Electrical precipitation has been found necessary in conjunction with some rotary type installations. For small properties, and high-grade ore, "D" retorts and Johnson-McKay tubes are used. Ore containing above 3 per cent mercury is usually considered high-grade. Small concentration plants are sometimes operated in connection with these retorts, which treat from 500 to 1,000 lb. of ore per charge, two charges per 24 hours. Their low over-all efficiency and the fact that recoveries do not customarily exceed 80 per cent, and may be as low as 50 per cent, are factors that restrict their field of application.

No special textbook is available on the geology of cinnabar and quicksilver ores, although most of the standard texts on ore and mineral deposits contain information on the subject. Bulletin 78 of the California State Mining Bureau is an exhaustive treatise on "Quicksilver Resources of California," and contains valuable information on the geology of the California deposits. A discussion of the metallurgy of quicksilver is also undertaken in this bulletin. Other sources of information on the metallurgy of this metal are: "The Metallurgy of Quicksilver," by L. H. Duschak and C. N. Schuette, Bulletin 222, U. S. Bureau of Mines, obtainable from the Government Printing Office, Washington, D. C., for 30c. postpaid; "The Metallurgy of Quicksilver," by Murray Innes and H. W. Gould, Chapter XXXV, Vol. 2, "Handbook of Non-ferrous Metallurgy," Donald M. Liddell, editor in chief, obtainable from the McGraw-Hill Book Company, 370 Seventh Ave., New York, N. Y.

* * *

Iodine for Industrial Purposes

"I have been asked by a manufacturer who is interested in obtaining 30,000 lb. of iodine if it is possible to obtain this quantity at a reasonable industrial price. It occurs to me that you may be in a position to give the required information."

The only possible source of such an amount of iodine at a reasonable price is Chile, where an insignificant proportion of the total amount recoverable is obtained as a byproduct in the treatment of caliche for its nitrate content. No one concerned in this industry is apparently interested in expanding the uses of the element beyond its present extremely limited scope, mainly for pharmaceutical purposes, because such expansion would involve some lowering of price to the consumer. The policy of the Chilean government has been to give tacit approval to an appalling waste of one of the country's most valuable natural resources, and it would seem a hopeless task to persuade those in a position to remedy the situation that an encouragement of wider uses of any product and the avoidance of waste are desiderata essential to sustained commercial prosperity in these days of intensive competition.

It is suggested that the manufacturer in question may be able to use bromine in place of iodine. If so, he can take advantage of a fair market price, the result of an expansion of this industry in recent years.

* * *

Fluorspar Tariff in Statu Quo

"Can you tell me the present status of the movement to have the tariff on fluorspar increased?"

More than a year ago the domestic producers of fluorspar applied for an increase in the duty, which is $5.60 per long ton. The steel manufacturers appeared in opposition to the application. The Tariff Commission has been making a study since and the final report is now in preparation. No estimate can be made as to when the report will be sent to the President.

By the Way

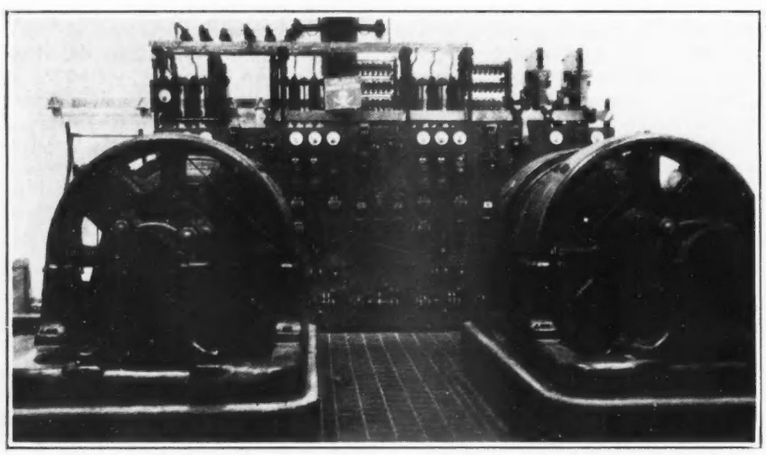
Buried Treasure Still Attracts

QUEST for several million dollars' worth of gold and silver supposed to have been buried in 1767 by Jesuits at Inquisivi, Bolivia, is the object of a British expedition which arrived at Arica, Chile, recently, en route for Bolivia, states an Associated Press dispatch. The treasure hunters are equipped with modern salvage tools.

Two hundred tons of material, trucks, motorcycles, oxygen respirators, sounding rods, an electric light plant and all sorts of mining tools were landed from the ship. The enterprise is based on old documents which apparently have certain historic value, and according to which a large treasure was buried by the Jesuits in 1767, when they were compelled to make a hasty exit from America through a decree issued by Charles III, King of Spain. That monarch expelled from all his domains members of the Society of Jesus and ordered that their property be turned over to the Crown. The documents state that the Jesuits of Inquisivi, in order to prevent their wealth from falling into the hands of the king's men, buried gold and silver bullion worth several million dollars. The company was organized in London in January last, with a capital of $125,000, as a frankly speculative undertaking for the so-called Jesuit gold in Bolivia. The secret of the hiding place of the treasure is supposed to be contained in a document by Father Gregorio San Roman, one of the deported Jesuits, which came last into the hands of Cecil Herbert Prodgers, an English explorer. Mr. Prodgers made a preliminary search for the treasure, the value of which has been estimated up to $60,000,000, in 1926.

INDUSTRIAL PROGRESS

Automatic Power Switching Equipment Used by Anglo-Chilean



Two of the five 300-kw., 600-volt, d.c. synchronous motor-generator sets supplying power to the storage battery locomotives of the Anglo-Chilean Consolidated Nitrate Corporation, Tocopilla, Chile. The switchboard is in the background.

AS A POWER SUPPLY for the twenty-three 30-ton storage battery locomotives used by the Anglo-Chilean Consolidated Nitrate Corporation for the pampa operation of its plant at Tocopilla, Chile, five 300-kw., 600-volt, direct-current, synchronous motor-generator sets have been installed, together with the necessary automatic switching equipment, according to J. J. Huether, of the Industrial Department of the General Electric Company, who describes the installation as follows:

The control of these five motor-generator sets involves a complicated scheme for operating any one by itself or in parallel with any one of the remaining four. This requires the installation of load-balancing relays to balance the load between any two of the sets. Originally, three sets were installed at a time when only thirteen locomotives were operated, but, with the addition of ten more locomotives, two more sets as well as automatic switching equipment were required.

This switching equipment provides automatic starting and stopping of each motor-generator set independently, by manually opening or closing a master switch which, in turn, automatically connects the synchronous motor to a reduced voltage source and, after reaching approximately synchronous speed with the exciter and generator voltages built up, automatically connects the motor field, pulling the synchronous motor into step and connecting it to full line voltage. Load-control equipment is provided to regulate the load on each machine, causing it to operate with only its particular share of the load. Full automatic protection is provided against abnormal line voltage or single-phase failure, unbalanced phases, prolonged overload, reverse current, incorrect starting sequence, short circuit, field failure, over-speed, over-heated bearings, and flashing to ground.

Reclosing feeder equipment is provided to open any particular feeder on voltage failure or a predetermined overload. The equipment keeps the feeder disconnected for a definite time, making no attempt to reclose as long as the excessive overload remains connected, and recloses the feeder after a definite minimum time, provided the voltage is restored and the excessive load has disappeared.

The complete equipment provides control for five motor-generator sets and four feeders, each feeder having a time-delay tripping contactor so interlocked that, when a particular machine becomes overloaded, the feeders will be disconnected at the rate of one every two seconds. This continues until the machine overload is reduced.

An arrangement is also provided in connection with this motor-generator set by means of which the storage batteries of the locomotives can be charged at the power station. This utilizes a balancer set with suitable control and battery-charging equipment, operating at 300 volts from the 600-volt power supply of the motor-generator set. In addition, four of the locomotives are equipped with battery-charging motor-generator sets installed in the cabs and operating from the trolley.

The Cost of Geophysical Work

WHAT is the cost of geophysical prospecting? This question was raised at the symposium on geophysical methods of prospecting which was a feature of the recent A.I.M.E. meeting in New York. Since then, the Askania Werke A.G., of 1024 Marine Bank Building, Houston, Tex., has prepared the data given below relative to the cost of operation of its magnetometers and of its torsion balance, automatic recording being used with the latter. The data are given as submitted by the company:

Ten thousand acres can be covered by 100 stations, one station every 1,800 ft. With an average speed of 25 stations per day and instrument, two magnetometers will cover the above area in two days. One instrument is used as stationary instrument with the observatory. With reference to the above figures, this means for an area of 10,000 acres that the cost of operation with two field instruments and one re-

Cost of Operation of Askania Magnetometers

Cost of equipment	
3 vertical magnetometers at $870	$2,610.00
1 recording outfit for recording magnetic daily variations	1,070.00
	$3,680.00
Cost of operation	
2 observers at $175	$350.00
1 observatory man	175.00
3 men room and board at $90	270.00
3 per cent depreciation on $3,680	110.40
3 Chevrolet coupes at $2,000	
1 tent for observatory 300	
$2,300—10 per cent	230.00
General expense for three cars	120.00
Total cost per month	$1,255.40

Cost of Operation of One Askania Torsion Balance With Automatic Recording

Price of one instrument with automatic recording device, usual accessories and training in the handling f.o.b. Houston, Tex.		$5,400.00
3 per cent depreciation on $5,400		$162.00
10 per cent depreciation on 1 half-ton truck	$800.00	
1 Chevrolet sedan	800.00	
1 Chevrolet touring car	650.00	
1 tent for balance	400.00	
	$2,650.00	
		265.00
Upkeep and general expense for 3 cars		150.00
1 observer, salary		250.00
1 surveyor, salary		150.00
3 helpers, salary		300.00
5 men room and board at $90		450.00
Cost per month		$1,727.00

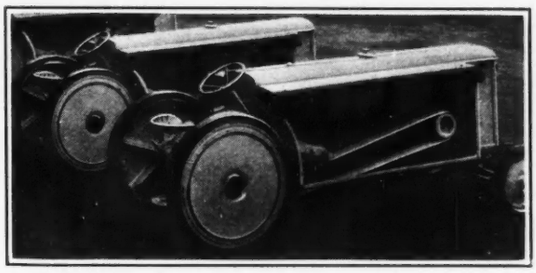
cording station is $85, or $0.0085 per acre, or $0.85 per station.

Five thousand acres can be covered by 42 stations, there being one station every half mile. With an average speed of three stations a day, it will take approximately 14 days with one instrument and 7 days with two instruments to cover the whole territory. With reference to the above-mentioned figures, this means for an area of 5,000 acres: Cost of operation with one instrument is $865, or $0.17 per acre, or $21 per station. Cost of operation with two instruments is $700, or $0.14 per acre, or $17 per station.

Cost of Operation of Two Askania Torsion Balances

As stated above, cost for one balance is		$1,727.00
3 per cent depreciation on second instrument		162.00
10 per cent depreciation on one half-ton truck	$800.00	
1 touring car	650.00	
1 tent for balance	400.00	
	$1,850.00	
		185.00
Upkeep and general expense for two cars		100.00
1 more surveyor		150.00
2 helpers		200.00
3 men room and board at $90		270.00
Cost per month		$2,794.00

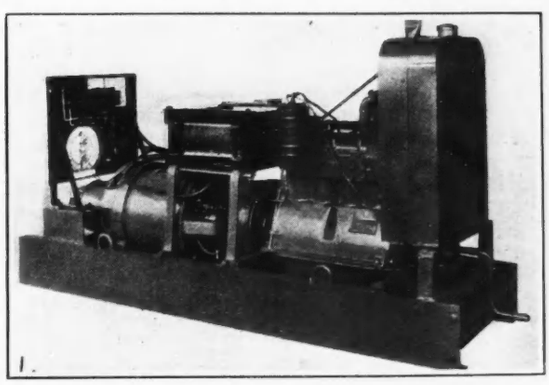
The Equipment Review



A new welder-tractor combination in which a new type of welder is used

THREE new welding devices have been announced in the last few weeks. One of these is an improved combination of welder and Fordson tractor introduced by General Electric. The improvement consists principally in the substitution of a new type of electric arc-welding equipment and the addition of head and tail light and a protective cover. The tractor is belt connected to a 25-volt, 300-amp., one-hour rated 1,750-r.p.m., ball-bearing generator.

The second device is a 200-amp. single-operator welding set introduced by Westinghouse. This set may be started by connecting it directly across the line. Starting and stopping are effected by a pushbutton. The arc current may be adjusted accurately over the entire welding range of 60 to 300 amp. in steps of 5 amp. The motor is wound for 220 or 440 volts and is assembled with the necessary connections for operation from a 3-phase, 60-cycle circuit.

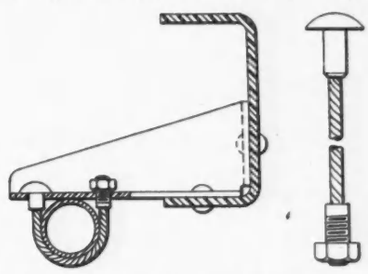


Gas-engine-driven arc-welder rated at 200 amp.

A new 200-amp. welding set requiring a single operator

The remaining device is a new gas-engine-driven model of the "Stable-Arc" welder introduced by the Lincoln Electric Company, Cleveland. This unit is rated at 200 amp., with a current range for welding duty of from 50 to 300 amp., and is operated at a speed of 1,500 r.p.m. It has been designed to meet the need for a light, sturdy unit. The unit weighs 1,580 lb. and is 76 in. long by 25 in. wide.

The accompanying drawing shows the "Tru-Lay Tru-Loc" flexible bolt recently introduced by the American Cable Company, 215 N. Michigan Ave., Chicago. This is intended for use where rigid U-bolts are impracticable. Some of these uses are: as auxiliary hangers



A flexible bolt that is intended as a substitute for the rigid U-bolt

for power shafts, suspension brackets for overhead piping, shackle bolts for temporary wall boxes, tanks, and similar applications. The principle involved in this bolt is that of the preformed type of wire rope. Preforming the wires and strands to the exact helical shape they must assume in the completed rope results in a cable that does not require seizing, but which may be cut like a rod. This type of rope, it is said, permits a close-fitting attachment to be slipped on the unseized end of the rope and to be processed so that the steel of the fitting cold-flows into the interstices of the rope and thus becomes practically an integral part of it. Such fittings can be threaded for a nut or capped for a head.

NEWS OF THE WEEK

Summary

NORTHERN Manitoba's mineral wealth will be exploited with the aid of modern transportation and power facilities. Railroad construction to the Flin Flon camp is progressing rapidly. Page 707.

* * *

Output of the Hollinger mine is still affected by the damage done by the fire on Feb. 10. The mill is now handling 5,000 tons of ore a day. Normal tonnage is 6,500. Page 711.

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Consolidated M. & S. of Canada will start work at once on the erection of a 100-ton unit to be added to the electrolytic zinc plant at Trail, B. C. Page 708.

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Arizona Metals and Bagdad Copper, in Yavapai County, Ariz., have added to their plants with favorable results. Page 709.

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Verde Central will build a 300-ton mill at Jerome, Ariz., at a cost of about $300,000. Page 708.

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Engels Copper struck a new ore-shoot below the No. 12 level recently. Page 707.

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Nicaraguan rebels capture American-owned mines in the Pis Pis district. Page 708.

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Changes in metallurgical treatment at Wiluna Gold, in Western Australia, may effect considerable savings. Page 711.

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Hearing for the purpose of examining complaints on mine valuations by the state tax department will be held at Houghton, Mich., May 14. Page 708.

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Russia is among the many large countries of the world with unexplored mineral areas. Soviet authorities are attempting to realize some of these potentialities by the use of modern methods. Page 708.

Attorney General Advises Against Reopening of War Minerals Claims

Soviet Manganese Royalty Oppresses Harriman Interests—Geologic Research Important to Dam Construction

By Paul Wooton
Special Washington Correspondent

IN A FORMAL opinion, Attorney General Sargent has advised the Secretary of the Interior that he would not be justified in reopening war minerals claims involving the purchase of mining property or to reimburse claimants for the amount of interest paid on sums borrowed for war minerals operations.

In requesting the opinion, Secretary Work asked the Attorney General if he would be justified, under any conditions, "to adjust, liquidate and pay net losses sustained in the purchase of real estate" and "to adjust, liquidate and pay net losses arising by reason of interest paid, or payable under obligations to pay, on money borrowed for use by operators in connection with operations under the law." Secretary Work stated that during his administration he had taken the position that claims of this character are not within the purview of the statute and for that reason he had declined to reopen them. He declared, however, that certain claimants and certain members of Congress are urging that his construction of the law is erroneous and that further legislation is not necessary to the reopening of the claims.

In the opinion of the Attorney General, Congress at no time intended to pay, as a part of the encouragement given under the war minerals relief law, any claims which would arise in connection with the acquiring of property. He points out that provision for reimbursement for the acquiring of property was eliminated from the bill by the Senate and that the debate shows that a majority of that body were of the opinion that such a provision would be going too far.

A serious difference has arisen between the Soviet authorities and the Harriman interests in connection with the manganese concession, according to advices reaching Washington. Apparently the basic royalty is so great that the Russian product cannot meet the competition of manganese produced in certain other parts of the world. In addition, it is stated that the Harriman interests must compete with twenty or more large operators in Russia itself.

Since the reduction of the export duty by Brazil a large part of the manganese used in the production of steel in this country is coming from that source.

Dr. Elwood Mead, Commissioner of Reclamation, after having studied the causes of the failure of the St. Francis dam, near Los Angeles, Calif., declared that no investigation of foundation conditions for such structures is complete without the participation of a geologist. If a geologist had been present when the excavations were being made for the foundations of the St. Francis dam, it is said that he could have easily determined the unsuitability of the surface material to retain character under continuous saturation

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Mining Corporation Purchases Claims in Rouyn

MINING Corporation of Canada has purchased the Murray claims, adjoining the Noranda mine, in the Rouyn district of Quebec, from United Verde Extension, which has been carrying on active explorations for eleven months. The payment was in cash and covered a 90 per cent interest in the property with a five-year option on the remaining 10 per cent. Development on the property to date includes the sinking of a shaft near the Noranda boundary, 3,000 ft. of crosscutting and drifting, and some diamond drilling on the 235 level.

Another Rouyn property, the Marriott, has also been extensively diamond drilled. More than twenty holes have been put down, and it is said that mineralization has been encountered in each. Two new zones have recently been opened and the drilling is being centered around these.

At the Robb-Montbray property in Quebec, owned by Nipissing Mines, the main shaft has been sunk from 225 to 450 ft. and it will be continued to 525 ft. Several diamond-drill holes have been put down in the original discovery, but with the exception of small amounts of low-grade chalcopyrite, nothing of interest has been found to date.

Flin Flon property from the air

Power and Transportation Developments Necessary for Success of Flin Flon

Construction of Railroad from The Pas and Adequate Supply of Electric Power Are Vital to the Exploitation of the Low-Grade Copper-Zinc Deposits in Northern Manitoba

AN INTERESTING survey of the Flin Flon mining area, in northern Manitoba, has just been compiled by the Natural Resources Intelligence Service of the Canadian Department of the Interior. The Flin Flon area includes at least three important properties, the Hudson Bay Mining & Smelting's Flin Flon mine, the Sheritt Gordon property, and the Mandy claims.

Flin Flon Mines, owned and controlled by Hudson Bay M. & S., totals 153 mineral claims, comprising an area of about 6,000 acres. The claims are situated in both the provinces of Manitoba and Saskatchewan, and are approximately 85 miles northwest of The Pas. A branch railroad is now being constructed from the Hudson Bay Railway, at The Pas, to Flin Flon Lake. To date more than 50 miles of temporary track have been constructed, over which supplies for the remaining distance will be hauled. Because of the nature of the territory through which these last 35 miles must pass, considerable trestle work is needed, and construction will therefore be slower.

When payment for stock issued is completed, it is understood there will be sufficient funds to construct a mine plant, flotation mill with cyanide annex, copper smelter, and electrolytic zinc plant to mine and treat 3,000 tons of ore a day. About a third of the tonnage will be mined by electric power shovels from an open pit. Hydro-electric plants and transmission lines will also be constructed. Construction and completion of the necessary plant and works will require a period of about four years. When brought to the producing stage, it is estimated that the mills and smelter will require the employment of about 1,000 persons.

Among the other properties in the district are the Sherritt Gordon Mines, Ltd., recorded owners of 57 mineral claims situated around Cold Lake.

According to a report recently issued by J. C. Rogers, consulting geologist, the value of ore indicated by surface work and diamond drilling at the property is $206,000 per foot of depth. Mr. Rogers, after a study of all intersections through the orebody, including the recent diamond-drill results, estimates 14,792 tons per vertical foot, having a value of $13.94 per ton. Drilling results at the west end of the property show that the orebody is dipping somewhat less than was anticipated, the holes which were placed to cut it at 500 ft. having intersected at approximately 400 ft.

Progress is being made on the development program laid out for the year. All equipment and supplies, amounting to more than 2,200 tons, have been delivered on the property. Installation of hoists, compressors, and auxiliary equipment is nearing completion at the two shafts, and headframes are being erected. Both shafts have been sunk and timbered a distance of approximately 100 ft.

Mandy Mines, Ltd., owns 27 claims south of those of the Flin Flon. In addition there are many of the inevitable smaller companies, any one of which may happen to strike it rich.

Available power sources for the Flin Flon area are many. The Island Falls site, on the Churchill River, is 55 miles from the district. It has a capacity of 76,000 hp. at ordinary minimum power and 95,500 hp. at six months' flow. White Mud Falls, on the Nelson River, is 180 miles distant and has a capacity of 180,000 hp. at minimum flow and 290,000 hp. at ordinary six months' flow. Two sites at Grand Rapids, on the Saskatchewan River, about 150 miles away, have an aggregate capacity of 53,000 hp. at minimum and 180,000 hp. at six months' flow. Though it is reported that the White Mud Falls site has been selected as the source of power required, no final official arrangements have been effected.

The northern part of Manitoba, including the Flin Flon area, falls within the Laurentian geological division of North America, which is in marked physical contrast to the Great Plains division embracing its southern prairies. Predominating surface features of the northern area are its rocky and rugged irregularities and its network of countless lakes and streams.

The accompanying illustration was made in connection with the aërial surveying by the Royal Canadian Air Force, in co-operation with the Topographic Survey.

Engels Copper Discovers Ore-shoot Below No. 12 Level

IN SINKING the sump below level 12 of Engels Copper at Engelmine, Calif., a new shoot of ore was encountered. Excavations for ore and waste pockets, started at a point 60 ft. below Level 12, indicated a width of 20 ft. of ore, and drill holes showed an additional four feet. The best ore appears in the bottom of the sump. The station cut upon Level 12 showed a continuation of the ore, and it was also picked up on Level 11. Samples show a higher gold content and ore richer in copper than the average. Further exploration will be required to determine the importance of the new strike.

Eleanor Placer Mining, organized by C. E. Herron and associates, is preparing claims on the Eureka Channel, in Sierra County, Calif., for operation. The property is 9 miles north of Downieville, and tailings storage has been acquired at the Bullard's Bar reservoir. Ditches are being constructed. The same interests have formed the Lincoln Placer Company, to mine placer ground within the town of Downieville, Calif.

Suspension from trading on the Los Angeles Stock Exchange of the stock of New Gibraltar Controlled Mines was ordered by officials of the exchange pending investigation. The company controls mining claims in Arizona and Nevada.

Heninger brothers are reported to have opened up a channel gravel deposit on Coffee Creek above Carrville, Trinity County, Calif., and below the Old Nash mine. Operations are to be resumed upon the Nash placer mine. Two 35-ton steam shovels are reported to have been purchased and are to be used for mining purposes. The Buckeye placers below Carrville are being operated.

At the Four Aces mine, Forest Hill, Calif., a new hoist has been installed. A ten-stamp mill is being operated two shifts per day.

Additional equipment is being placed at the Two Handy mine, near Brown's Valley, and a new shaft is to be sunk. The Two Handy ledge was uncovered in dredging operations and is being explored by Yuba Consolidated Gold Fields.

Spanish Mining, operating in the Washington district, Nevada County, Calif., has made application for water diversion from Poorman Creek for power purposes. A mill is to be constructed and mine equipment installed.

Consolidated M. & S. to Start Work on New Unit at Once

CONSOLIDATED M. & S. Company has announced that work will be started at once on the erection of a new 100-ton unit to be added to its electrolytic zinc plant at Trail, B. C. This will bring the total capacity of the zinc plant up to 375 tons. It is expected that operation will start early next year, when the 60,000-hp. hydro-electric plant at Bonnington Falls, B. C., on the Kootenay River, should be completed. Owing to a shortage of current, the company has been able to operate the addition completed last June at only three-quarters of its capacity.

The research department of the company has been experimenting on the recovery of zinc from old lead smelter slags. This slag contains sometimes as much as 20 per cent zinc. It is said that research has met with such success that a plant for the recovery of 50 tons of zinc a day from slag and other zinc refuse will be started and will be in operation before the end of this year.

Treadwell Yukon's New Mill Equipment

In the report of the equipment for the new Treadwell Yukon mill, in the Sudbury district of Ontario, which appeared in the March 10 issue of *E. & M. J.*, mention was not made of the fact that the thickeners installed were of the 20-ft. Hardinge spiral type. Four of these will be used when the new mill is in operation. The courtesy of the manufacturer in directing attention to the omission is appreciated.

Russian Gold Industry Said to Be Expanding

RECENT purchases of American machinery for mining operations by the Soviet gold trust for use in Russia have focussed attention on the gold industry of that country. Russia, in common with some other countries of the world, has large unexplored potential gold-bearing areas. Recently new deposits have been opened in the Aldan district, in Yakutsk territory. Other deposits have been located in northeastern Siberia.

At present the principal gold producing areas are in Siberia, the Ural Mountains, and the Caucasus. In the Olekma-Vitim district, in the Lena-Baikal region, the Lena Goldfields concession produces about 35 per cent of the total output of the country. This company has made considerable progress in mechanizing the production processes since receiving its concession from the Soviet government in 1925. It will put a powerful 17-ft. dredge into operation this summer. This dredge was purchased in the United States. It will be operated by hydro-electric power.

A number of measures have recently been taken by the Soviet economic authorities to improve the condition of the gold industry. The nine former trusts have been united into one large company, the Soyuz-Zoloto (Union Gold). An initial sum of 24,000,000 rubles has been assigned to this company, mainly for new equipment for the industry. The five-year plan for the gold industry calls for the installation of 22 dredges, of which 7 have already been ordered. The state economic organs aim to bring the industry to a point beyond its pre-war position within a comparatively short time.

Favorable conditions are offered individual prospectors, who are exempt from all taxes paid by the industries. It is believed that these terms will attract many individual prospectors and will increase the production from this source.

Hearing on Mine Valuation at Houghton, Mich., on May 14

VALUATIONS of copper-mining properties in Michigan have been made recently by the state tax department, and these figures will be submitted to the tax commission at a hearing in Houghton, Mich., on May 14. The hearing is held for the purpose of examining complaints and possibly effecting reductions in valuation. An average of the closing quotations on the stock market for each Monday in the year was formerly used as an indicator of values, but it proved to be unreliable. At present the tax department places an arbitrary value on the property after considering such items as profits, cost analysis, physical condition, and reserves.

Shipments from the copper districts have fallen off lately and metal business is only fair. Navigation is expected to open soon, and until then shipments may be held up.

Shaft sinking at Arcadian Consolidated's New Baltic is now down to the 1,615 level and will continue at least to the 1,750 level. Exploratory work on the veins opened at the 1,250 level will then be attempted in the hope that mineralization at depth will be more consistent.

Crosscutting on Mayflower-Old Colony's 1,750 level continues. Copper rock was struck in a lode 3,500 ft. from the shaft, but it was not in commercial quantities.

A much greater percentage of the copper-bearing rock will be extracted by the adoption of the retreating system at the Quincy mine, it is expected. Less timber will be needed, and pipes, trackage, and other equipment can be salvaged as the stopes are worked out and abandoned. An important factor in future mining at depth in Quincy is the width of the East lode in the bottom levels of the No. 2 shaft, now being retimbered above the 52 level. Before the shaft was put out of commission by the fire last fall, the vein had been opened a total of 650 ft. of incline depth on the formation.

Nicaraguan Rebels Capture Mines Owned by Americans

According to dispatches received by New York newspapers on April 24, Augustino Sandino, leader of the rebellious Nicaraguan forces, has seized two American gold mines in the Pis Pis district of Bluefields. The mines are the La Luz and Los Angeles Mining properties near Amparo, on the Prinzapolka River, and the Bonanza mine of Bonanza Mining Company, 15 miles further down the Prinzapolka River. The rebels have seized five employees of the mine, three of whom are Americans.

The La Luz mine is controlled by the Fletcher brothers, of New York. According to the dispatches, a five-mile pipe line to the property had just been finished at a cost of $150,000, and if this line was wrecked the mine would be put out of operation for a year and a half. The monthly production has averaged about 500 oz. gold.

The Bonanza mine is owned by Philadelphia interests, of whom Benjamin C. Warnick is the head.

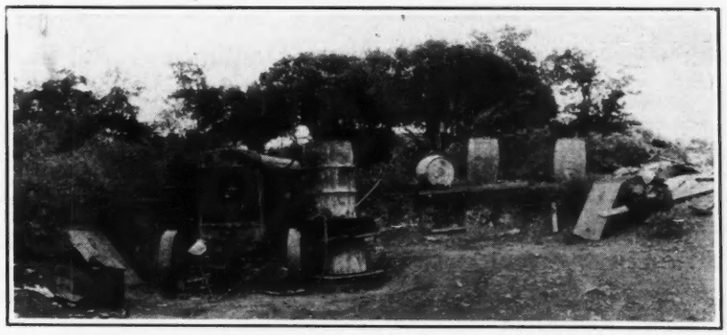
Dispatches received on April 25 state that three more mines have been captured, but they had not been producing for some time. George Marshall, one of the men captured, is reported to have been killed. Harry Amphlett, superintendent of the La Luz mine, was released or escaped and reached the coast safely, according to these reports.

Verde Central to Build 300-Ton Mill at Jerome

FUNDS are being raised by Verde Central, controlled by Calumet & Arizona, for the purpose of building a 300-ton mill at Jerome, Ariz. Stockholders of record on May 1, 1928, will be offered an opportunity to buy one share at the par of $1 for each six and two-thirds shares in their name. A total of 300,000 shares will be offered. Calumet & Arizona has been conducting explorations at the Verde Central for several years. Development to date is said to be sufficient to warrant the erection of a mill. Work is being conducted principally in diamond drilling in the hope of striking a large orebody, as developments have so far indicated only the presence of small orebodies.

British Iron and Steel Institute to Meet May 3-4

The annual meeting of the British Iron and Steel Institute will be held at the Institution of Civil Engineers, Great George St., London, on Thursday and Friday, May 3 and 4, 1928. The annual dinner will be held in the grand hall of the Connaught Rooms, Great Queen St., on Thursday evening at 7:30 p.m. The installation of the new president of the Institute, B. Talbot, will take place on Thursday morning. He succeeds F. W. Harboard.



Portable compressor used for surface trenching and sampling at Arizona Metals

Small Properties in Yavapai County Are Making Progress

Arizona Metals and Bagdad Copper Among Companies Developing Their Claims and Adding to Their Plants With Favorable Results

AFTER about two years of intensive development work and testing of ores by leaching, Arizona Metals, situated in the Walnut Grove district, Yavapai County, Ariz., has signed a contract with Arizona Power, and electric power was first delivered at the Cuprite shaft of the Company's mine about April 19. The compressor and hoist that are to be used in the new program are already on the ground and are being placed upon the foundations. Timber for a 50-ft. headframe has been ordered, as well as lumber for the building to house the new machinery. It is expected that the crew now employed, numbering about 30, will be increased soon. The power will be taken off the Julian line about 4½ miles from the source of mining operations. With this addition to the equipment of the company it is hoped that development work will be speeded up. Last summer an experimental treatment plant was built and put in operation.

Arizona Metals' properties are said to total 2,000 acres, including 12,000 ft. along the strike of the ore channel, but no estimate of ore reserves has been given out. The company is a Delaware corporation and is privately financed. W. J. Loring is the general manager in charge of operations.

Bagdad Copper Corporation has taken over the Bagdad property, near Hillside, also in Yavapai County. This region is known as the Eureka mining district. Jack Lawler, one of the Arizona pioneers, located the property. Estimates of several engineers indicate that between 18,000,000 and 20,000,000 tons of ore, averaging 1.50 per cent copper, is available. The company places the figure at 20,000,000 tons in the sulphides and there is also said to be a large tonnage of carbonate ore on this property. George F. Thomas is general manager at the property. His experience has largely been in Canada, although he was connected for some time with the American Cyanamid Company, of New York.

Present activities are centering on the production of ore on a small scale, preparatory to larger developments. More than 120 churn-drill holes have been put down on the Bagdad. A pilot mill, of 50 tons' capacity, equipped with flotation and roasting equipment, is to be erected immediately. The leaching of calcines and the electrolysis of solutions will be undertaken at the plant. This is a new departure in the treatment of copper, the patent being held by the M. A. Hanna Company, of Cleveland, Ohio. This system has been worked out on a small scale in the laboratory at the properties.

Intensive development work is being done at the Sheldon mine, in the Walker district. The Blue Dick, in the Hassayampa field, has been shipping ore steadily for more than a year. Several leasers are at work on this property. Verde Central, which has been actively developed for several years by Calumet & Arizona, is pushing its program of development at its properties near Jerome. Its present crew is making progress of about 1,000 ft. a month. The company is employing 75 men.

George S. Bent is in charge of the development work at the properties of Boston Arizona Development, in the Copper Basin district. New machinery is being installed, which will permit of deeper development.

Evolution Mining Shaft to Be Sunk 400 Ft. Deeper

EVOLUTION Mining, in the Coeur d'Alene district, Idaho, has awarded a contract to extend its shaft 400 ft. deeper, as the present contract to sink 200 ft. is nearly completed. The shaft is sunk from the main tunnel level, following the vein, and has so far disclosed a promising showing of lead-silver ore. An electric hoist will be installed capable of going to a depth of 1,000 ft.

Evolution Mining is controlled by New York people. Conrad Wolfle, of Spokane, is manager. The Evolution is one of the early-day locations in the Coeur d'Alene district. It had been developed extensively in the past, but no ore in commercial quantity was found until the present development.

Sinking of the main shaft at the Sunshine mine, on Big Creek, in the Cœur d'Alene, is approaching the 800 level. It will be continued to a depth of 1,000 ft. The new electric hoist, which went into commission recently, was installed on the 500 level and is meeting all requirements.

Hecla Extension Mining has taken a bond on the Anchor Galena property, west of the Hecla mine at Burke, Idaho. A compressor will be installed and a hoist set up. The old shaft, sunk many years ago to a depth of 600 ft., will be unwatered.

The work of unwatering the Tiger-Poorman mine to the 600 level is about completed. Hecla Mining, which owns the property, will explore when that level is reached, in the hope that the silver-lead ore which the mine carries can be profitably mined by modern methods.

Cuprite shaft at Arizona Metals, now being electrically equipped

McKinley-Darragh Mill Completely Destroyed by Fire

Fire destroyed the mill of the McKinley-Darragh-Savage Mines at Cobalt, Ont., on the morning of April 8. The oil house, machine shop, and part of the tramway to the shaft were also burned, but the shafthouse was saved by the exertions of the fire brigade. Operations were discontinued at this well-known silver producer last June, as all available ore had been mined. The mill was partly dismantled at the time of the fire.

Mine Royalties Will Be Based on Profits in Western Canada

AN IMPORTANT change has been made by the Canadian government in the royalties on mines in Yukon and Northwest territories. It appears in a bill to amend the Yukon Mining Act, and although the bill does not state that the proposed scale of royalties shall be applied to the provinces of Alberta, Saskatchewan, and Manitoba, Charles Stewart, Canadian Minister of the Interior, says that this will be done by Order in Council. Mining companies, according to the new scale, will pay 3 per cent on earnings in excess of $10,000 and up to $1,000,000; 5 per cent on earnings from $1,000,000 to $5,000,000; 6 per cent on earnings from $5,000,000 to $10,000,000; and an increase of 1 per cent for each additional $5,000,000.

At present mining companies are compelled to pay royalties on production, regardless of profits.

Arizona Copper Belt Installs New Engine and Hoist

A 40-hp. electric engine and hoist have been installed recently at the No. 3 shaft of Arizona Copper Belt Mining, operating at Constellation, Ariz., according to W. J. Dilthey, president of the company. The property adjoins the Monte Cristo mines. A new headframe of heavier timbers has also been erected. The Amethyst ledge, which outcrops in the form of an iron dike or gossan, shows azurite and copper-gold ore on the surface. The work at the mines is being done by an operating, leasing, and development company known as Copper Belt Smelter. The No. 3 shaft is now down 250 ft.

Acadia Gold Installs Mill at Property in Nova Scotia

A twenty-stamp mill has been installed at the Acadia Gold Mine, in the Oldham district of Nova Scotia. It is expected that the mine will soon be producing sufficient ore to keep the mill in continuous operation. Power for the plant as well as for the town of Oldham is being supplied by a Diesel engine recently acquired by the company. The Acadia company is controlled largely by American capital. The Evangeline is the only other operating company in the district. It is financed by Nova Scotians and Montreal interests.

More Than 100 Claims Staked in Squaw Creek Field

Stampeders who have returned to Haines, in southeastern Alaska, from Squaw Creek report that more than 100 claims have been staked and that although development work is required to determine the richness of the ground, prospects for a new placer gold field appear favorable. The location is near Dalton Post, on the old Dalton trail. Little news is coming out of the interior of Alaska because of the breaking up of the roads with the spring thaw.

The Ninety-Six group, on Texas Creek, near Hyder, Alaska, in the Portland Canal district, has been bonded to a Tacoma, Wash., company.

Revival Mining Will Operate Sylvanite Mine in Oregon

AFTER a five-year shutdown the Sylvanite gold mine, near Gold Hill, Ore., will be reopened by the Revival Mining Company, which purchased it from Oregon-Pittsburgh Mining. Litigation was the cause of the suspension of operations. The Sylvanite claims include a number of mines, united into one property by J. G. Davies, of Sacramento, in 1916, and sold to the Oregon-Pittsburgh company in 1921 for $180,000. Development is by shaft and 6 tunnels, the shaft being bottomed at 700 ft. The equipment on the property includes a 75-ton mill employing crusher, 10 stamps, Hardinge mill, 2 Wilfley tables, Dorr classifiers, and 2 amalgamators. Both mine and mill equipment are electrically driven.

Steam-shovel equipment has been installed on the property of the Pleasant Creek Mining Company, 7 miles from Rouge River, Ore. Gravel is being moved on contract by the Arlington Construction Company, of Portland, with a 2,000 cu.yd. capacity shovel.

Phelps Dodge Honors the Memory of Two Bisbee Pioneers

IN MEMORY of two of the earliest pioneers of the Bisbee district, marble busts of Ben Williams and Dr. James Douglas have been placed on either side of the entrance to the Copper Queen offices in Bisbee. Ben Williams, after examining the Copper Queen claims in 1880, raised money to develop them and in the following year had them on a producing basis. Dr. Douglas was at this time in charge of a copper-reduction works at Phoenixville, Pa., to which some of the ores of the Queen claim were sent for reduction. He became interested in the claim and purchased options on adjacent ground.

Dr. Douglas had no money of his own, but he induced the firm of Phelps Dodge & Company, of New York, to take up his options and to send him to Bisbee to take charge of development work. Considerable litigation over apex rights followed, after which most of the claims in the district were merged in Copper Queen Consolidated Mining. James Douglas was the first president and Ben Williams was general manager, and these two men directed the growth of Bisbee for a score of years. Ben Williams retired from active service in 1899. He died at Los Angeles in 1925. The death of Dr. Douglas occurred in 1918. The statues of the two pioneers were unveiled with fitting ceremonies on Easter Sunday.

New Nova Scotia Deposit of Diatomite Are to Be Developed

DEVELOPMENT of a large deposit of diatomite or Kieselguhr, is under way at present at Little River, Digby County, Nova Scotia, and within the next two months shipments will have been made to markets, Dr. Robert Harvie, of Montreal, prominent Canadian geological authority, said recently on his return from visiting the scene of operations, according to the Halifax *Herald*. The machinery which is being installed is only temporary, and will provide for an output of about 25 tons a day, purely an experimental quantity.

The product comes from one bog, with an area of 50 acres, which has been drained. It has been proved to have an average depth of 12 ft. 6 in. There are eight bogs in all. Diatomite, Dr. Harvie said, is used for the manufacture of firebrick or other insulating material and is excellent for filtering purposes, a considerable quantity being used in sugar-refining operations.

The mine, Dr. Harvie explained, is strategically situated, being only a mile and a half from deep water, where a 500-ton schooner can be easily loaded. The main highway passes one corner of the property.

The officials of the company which has been formed to develop the property and which is known as "The Scotia Diatom Products, Ltd." include R. E. G. Burroughs, of Little River, president; M. F. Gregg, V. C., St. John; Dr. Harvie; R. E. Burroughs, Jr.; and Professor Flynn.

Kinzie Describes Quarrying Before San Francisco Section

THE San Francisco section of the A.I.M.E. at its regular meeting on April 10, 1928, devoted the evening to cement. E. A. Hersam presided. R. A. Kinzie discussed the important factors in the quarrying of materials, the preparation, grinding, burning, and final grinding of the clinker. He pointed out the parallelism that exists between the manufacture of portland cement and the average mining and milling enterprise, and said that in bench quarrying the most significant development has been the displacement of steam shovels by Diesels and electric shovels, the selection between the latter depending upon location and tonnage. Both electric tramming and the use of Plymouth gasoline locomotives are common. In some plants rolls are being used to finish preliminary crushing. Grinding is done by ball mills, compartment mills, and "Comp-Peb." Mr. Kinzie pointed out the differences between the dry and wet cement mills and spoke about the inefficiency of the rotary kiln. Air conveying and handling by screw and belt conveyors were also considered.

Jay E. Jellick discussed the use of cement, the importance of proper aggregates, and proportion of water.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Hollinger Output Affected by Fire—Now Treating Only 5,000 Tons Daily

TORONTO, April 21, 1928 — The Hollinger mine at Timmins, Ont., has not recovered from the effects of the fire on Feb. 10. At present only 5,000 tons a day is being treated, compared with the normal output of 6,000 to 6,500 tons. The shutdown occasioned by the fire caused a production loss of $500,000, but it is expected that in the second quarter of the year production will be back to normal.

The McIntyre mine, in the same district, as a result of deeper operations, is considering the installation of equipment for mechanical ventilation. Experts are being called in to advise the management.

On the 1,125 level of the Barry-Hollinger mine, near the Kirkland Lake district, a crosscut to the vein has shown 46 ft. of ore of a commercial grade. This oreshoot was first encountered on the 1,000 level, where it showed a maximum width of 20 ft. of ore assaying better than the average grade of the mine. The new development is considered to be important, as the oreshoot occurs in a practically undeveloped portion of the property. The winze is being continued to 1,500 ft.

SUDBURY Basin Mines, in the Sudbury district, has recently completed a crosscut on the 150 level of the Cheney copper property, which lies between Sudbury and Sault Ste. Marie, Ont. The crosscut shows 12 ft. of copper ore. This ore is free from lead and zinc and carries only a small percentage of iron pyrites. The operators expect that a high-grade concentrate can be obtained. The 250-ton pilot flotation mill at the Errington mine, in the same district, is practically ready for operation. In the immediate vicinity of the shaft adjoining the mill, representing only a small portion of the area in which ore has been indicated by diamond drilling, 1,000,000 tons of ore has been developed.

At the annual meeting of the Howey Gold Mines, held in Toronto, it was stated that the average value of the ore developed to date at the mine in the Red Lake district was approximately $7 a ton, but better ore has been disclosed on the 500 level, and the presence of tellurides on this level has been confirmed. It is proposed to make an immediate start on 10,000 ft. of diamond drilling. Holders of the old Howey units were advised that the units would be called in about July 1, the exchange basis being 400 shares of Howey Gold Mines stock for each unit.

Noranda Mines, in the Rouyn district, is shipping more than 40 tons of blister copper a day. Improvements in crushing and utilization of waste heat indicate that the 500-ton units at the plant are capable of treating 1,000 tons a day, as 1,050 tons was put through in one day recently. The "C" orebody on the 400 level, which was cut recently, showed 25 ft. of copper ore running better than 6 per cent. In shaft sinking between 800 and 850 ft., some narrow high-grade veins have been encountered, in addition to low-grade ore. Although not of great importance in themselves, they indicate possibilities of a substantial orebody in the vicinity. At the Waite-Montgomery, which is controlled by Noranda, the new orebody recently found has been drifted on for more than 40 ft.

Mexico City Letter

BY W. L. VAIL

Special Correspondent

War Department Will Issue Permits for Importation of Dynamite

MEXICO CITY, April 17, 1928—Upon petition of a number of the larger mining companies, the Mexican War Department has decided to issue yearly permits for the importation of dynamite and other explosives, in unlimited amounts. No special permits will be required, but the companies will be obliged to give a strict accounting from time to time as to the use of explosives imported and to observe the regulations governing the importation and handling of explosives.

Mine operators have again been reminded that sales of mining properties, whether acquired prior to the new mining laws or since these went into effect, require permission of the Department of Commerce, Labor, and Industry to make the transfers valid. In certain quarters the impression prevailed that this requirement applied only to transfers of properties acquired since 1922. The government desires at all times to be in possession of exact information regarding actual ownership of properties in the republic.

AMONG the properties recently reopened are the old Arco mine, at Copala, Sinaloa, now owned by the Premier Mining Company, of Seattle, Wash., the Panuco mines, situated at Concordia, Sinaloa, which were formerly important producers; the Magistral mines, at Ameca, Jalisco, again opened and preparing to work on a large scale; and El Consuelo, in the municipality of Texoatlant, Oaxaca, idle for a number of years. All these properties are in the control of American capital.

Reports from Jalisco state that the Tigre Mining Company, which took over the El Favor properties on a working basis, continues to make test treatments. A number of small operators are going into the neighboring regions of Nayarit, formerly Tepic.

London Letter

BY W. A. DOMAN

Special Correspondent

Developments at Wiluna Gold Favorable—Annual Meeting of Rio Tinto Held

LONDON, APRIL 10, 1928—The metallurgical methods employed at the Wiluna Gold mine, in Western Australia, have recently been investigated, and, according to a cable received here from Kalgoorlie, H. E. Vail, the general manager, reports a discovery which he regards as of great importance. The results obtained have been confirmed by Alfred James. It is said that the decision of the company to adopt a flotation process for recovering a concentrate and then treating it by cyanide will effect a saving of 3s. a ton. Such a figure naturally would make a great difference at this property, and presumably the critics who originally suggested that sufficient allowance had not been made for working costs may now revise their view. At the end of last year, 922,400 tons of 40s. ore was developed. Since then diamond drilling has disclosed a third lode to the east. It has been proved over a distance of 400 ft. with a width of from 4 to 5 ft. Ore contents are said to be above the mine average.

AT THE annual meeting of shareholders of the Rio Tinto Company last week, some important and interesting statements were made by the chairman, Sir Auckland Geddes, both from the financial standpoint and that of recoveries. After dealing with the low price of copper, Sir Auckland pointed out that the 50,000,000 Spanish peseta 6 per cent loan had now all disappeared, and the Rio Tinto Company had guaranteed the principal and interest of £300,000 5½ per cent debenture stock issued by the Pyrites Company. The latter company is now absolutely owned by the Rio Tinto Company, and acts as the distributor of Rio Tinto ores in the United States, apart, of course, from its metallurgical business in Wilmington, Del.

The present Rio Tinto Company has been in existence 55 years, having begun as a mining company operating in Spain. Besides its Spanish operations, it is working at present in not fewer than 22 different countries, and it is no longer concerned only with mining. It is arranging to follow its ore into metallurgical and chemical processes. Sir Auckland said, "We are today the center of an organization controlling the annual distribution of over 3¼ million tons of ore, produced in many countries, influencing, through arrangements, the distribution of ore produced by companies we do not control, and working in friendly agreement with still other producers." A satisfactory arrangement has been made with the Cyprus Mines Corporation.

Societies, Addresses, Reports

American Zinc Institute, Meeting at St. Louis, Plans Research and Trade Extension

By J. H. Wadleigh
Special Correspondent

AN EXTENSIVE and comprehensive research division, backed by an aggressive trade extension program, was advocated as a means of bringing the zinc industry out of its present unprofitable quandary at the tenth annual meeting of the American Zinc Institute, held at the Statler Hotel, St. Louis, April 16, 17 and 18.

The possible extension of the membership of the Institute, by the incorporation of the lead interests with that of zinc, and the forming of a galvanizing section of the Institute, to include manufacturers of zinc-coated sheets, were mentioned as possible means of bringing relief to the zinc industry, a relief badly needed if conditions are as unfavorable as was indicated by discussions in the open meetings.

Believing that only through a trade association, such as the Zinc Institute, can the industry hope to go forward as a unit, and solve its problems, of which over-production, of both metal and concentrates, seems to be the uppermost at present, the directors had had printed, in booklet form, a record of the accomplishments of the Institute during its ten years of existence. E. H. Wolff read this report for the directors. R. M. Roosevelt, who was presiding, then called on A. P. Cobb, A. E. Bendelari, F. C. Wallower and Mr. Wolff, past presidents of the Institute, for further remarks. Research work was stressed as a need for any industry by N. P. Rood, vice-president of the Hercules Powder Company. Through effective research development, he thought the zinc industry could make rapid strides. Others who advocated a greater amount of research work were P. W. George, Jesse G. Starr, and W. F. Rossman. Following these discussions, the members by a rising vote endorsed the work of the Institute.

P. B. Butler advocated the combining of the zinc with a proposed lead institute, stating that it would "open up vistas that can hardly be imagined now." The proposal was later discussed by the board of directors, when it was learned that the lead interests had practically completed arrangements for the organization of an institute of their own, having gone so far as to have tentatively chosen a secretary, so the idea was tabled for discussion at some future date.

Mr. Roosevelt, vice-president of the Eagle-Picher Lead Company, was elected president of the Institute for the coming year to succeed Jesse G. Starr. Mr. Starr was elected first vice-president; Mr. Butler, second vice-president; John A. McCarthy, third vice-president; Howard I. Young, treasurer, and S. S. Tuthill, secretary. Eight directors, A. E. Bendelari, A. P. Cobb, A. M. Gaines, L. E. Wemple, E. H. Wolff, J. F. Robinson, Charles T. Orr, and W. F. Rossman, were re-elected directors to serve for three years. Edgar L. Newhouse was elected a director to succeed A. J. McKay, resigned. The new board of directors appropriated funds for the printing of the "Zinc Workers' Handbook," which should be completed within the next few months, and voted to discontinue the mid-monthly slab zinc statistics.

Intelligent Direction of Industry Function of Trade Association

More intelligent direction of the growth of industries to insure sound development will be one of the chief functions of the trade associations in the future, Dr. Hugh P. Baker, manager of the trade association department of the United States Chamber of Commerce, declared. The Monday afternoon session was brought to a close by the reading of a paper on "Prevention of Accidents" by Henry Giessing.

The annual gathering was called to order at 11:30 a.m. Monday by President Starr, who introduced Victor J. Miller, Mayor of St. Louis, who welcomed the visitors. Henry S. Wardner made the reply of welcome. Telegrams were read from Herbert Hoover, Charles Schwab, and Scott Turner. Appointment of committees and the reading of the "World Zinc Survey" of the International Metal Service ended the first session. The high lights of the afternoon session have already been related, and a smoker Monday night brought the first day's activities to a close.

The major part of Tuesday's session was devoted to the galvanizing situation, at which representatives of the makers of galvanized sheets were present. Mr. Wallower, chairman of the galvanizing committee, presided.

Zinc Industry Chided for Lack of Co-operation

The zinc industry was scored by Harry S. Rogers, of the Sheet-Steel Extension Committee, in his paper, "Brothers-in-law in Business." He said that the zinc industry had done little to help the committee in its endeavor to increase the use of galvanized products. The sheet-steel committee had done a great deal in stimulating the demand for zinc-coated sheets, but must eventually turn its attention to other interests among the sheet-steel industry. He also said that the Institute had virtually committeed a "breach of promise" for its failure to contribute to the committee's work. Last year, he said, the Institute promised to raise $25,000 to be spent by the committee, but so far it had received only $1,645.

Mining Men Promise to Help Galvanizing Committee Research

Mr. Wallower said that the committee had been tentatively promised between $15,000 and $25,000. The Institute a year ago agreed to match dollar for dollar any funds subscribed for this purpose, and all that was subscribed was $822.50 in the mining field. Although no action was taken, a number of mining and smelting men agreed to see that a suitable fund was raised to help the committee in its efforts to increase the use of zinc-coated products.

Mr. Butler, in reporting for the adjustment committee, suggested that if the committee was to be retained the name be changed to that of the relations committee.

Captain Irving O'Hay was the principal speaker at the annual banquet held Tuesday night. President Starr presided.

The Wednesday morning session was opened by the reading of papers prepared by C. E. Siebenthal and Otto Ruhl. Mr. Orr presided at the meeting, most of which was devoted to a discussion of the Waelz process, and of a paper, "The Metallurgical Treatment of Flotation Concentrates," written by Arthur S. Dwight, and presented at the last annual meeting of the A.I.M.E. H. J. Stehli presented Mr. Dwight's paper. The morning session was brought to a close by the reading of a paper by Mr. Young on the past and present production of zinc west of the Mississippi River and to what extent it has been affected by the recent improvement in flotation.

The Wednesday afternoon session was a round-table discussion under the auspices of the U. S. Bureau of Mines, at which Arno C. Fieldner presided. Papers were read by C. O. Anderson, W. H. Coghill, Theodore Marvin, Dr. R. R. Sayers, and Prof. H. R. Hanley. A resolution was passed asking Congress to increase its appropriations from $25,000 a year to $50,000 for the maintenance of the U. S. Bureau of Mines experimental stations and that at least ten of these be maintained.

At the closing session, President Roosevelt announced the personnel of the executive committee, which under the revised bylaws will be the major governing body of the Institute, as follows: A. P. Cobb, B. N. Zimmer, J. A. McCarthy, and P. B. Butler. Two alternates were named at the time, E. H. Wolff and W. A. Ogg. The eleventh annual meeting was voted to St. Louis, the date to be set by the board of directors.

Book Reviews

A New Edition of "Mineral Deposits"

MINERAL DEPOSITS. By Waldemar Lindgren. Third edition. Comprising 1,049 pages, plus xx; with 317 figures. McGraw-Hill Book Company, New York, 1928. Price $7.

THE fact that it was found necessary to prepare a new edition of this standard reference book after a lapse of only eight years speaks well for the popularity and utility of this unique and monumental work.

The new edition is larger by 92 pages than the edition of 1919; two more chapters have been added to it, and the illustrations have been increased by 33 text figures. Dr. Lindgren has taken advantage of the need for revision by bringing the present volume up to date in the treatment of those chapters dealing with physics and chemistry, the composition of the earth, magmas and their relation to mineral deposits, and the more recent information relating to new discoveries and developments.

Chapter I has been revised and a little new matter in the form of a brief discussion on processes of mineral concentration has been incorporated. Chapter III, on "Atmosphere, Hydrosphere and Underground Waters," is new, very brief, and in the opinion of the reviewer adds nothing to the book; the subject-matter of this chapter should have been included in Chapter IV, which deals with underground water, or in Chapter V, which treats of the composition of underground water. Chapters VIII and IX should not have been separated from Chapters III, IV and V, since all of these chapters are concerned with the groundwater and its work, and should follow one another in sequence without the injection of such matter as "The Spring Deposits at the Surface," Chapter VI, and "Relations of Mineral Deposits to Mineral Springs," Chapter VII.

The subject-matter of Chapter X, entitled "The Magma in Its Relation to Mineral Deposits," is an important addition to the book. In the edition of 1919 this was treated unsatisfactorily and very incompletely in Chapter XXIX. In the new chapter the constitution of the magma is defined, the crystallization of magmas and the causes of volcanism are briefly discussed, the subject of differentiation, including liquid immiscibility, crystallization differentiation, and differentiation by gas transfer, and the relations of intrusive magmas to mineral deposits, the zonal theory, the succession of minerals in ores, and the character of solutions forming mineral deposits, are all briefly discussed and a short general review of ore deposits with magmatic affiliations is given. This is a decided improvement on the subject-matter of Chapter XXIX of the older edition and it enhances the value of the book materially.

The chapters dealing with "Folding and Faulting," "Openings in Rocks," and "The Form and Structure of Mineral Deposits" have been but very slightly modified, but the chapter on "Texture of Mineral Deposits" contains new matter on diffusion and "unmixing" from solid solutions, and new text figures illustrating structures formed by "unmixing." Dr. Lindgren is open-minded with respect to the latter process, for he states, "It is fair to add that no complete unanimity reigns in regard to the interpretation of many of these phenomena."

There is no modification of the treatment of classification, Chapter XVI, with the exception of the introduction of the new terms "epithermal," applied to deposits made at slight depth and moderate pressures and temperatures; "mesothermal," applied to deposits made at intermediate depths, under higher temperature and pressure conditions, and "hypothermal" for deposits made at greater depths under very high pressures and at temperatures between 300 and 500 deg. C. Deposits of these types are discussed at length in Chapters XXVI to XXVIII inclusive, comprising 264 pages, just about one quarter of the book. The new terminology makes for conciseness in description, but adds an additional burden to our nomenclature, which is regrettable, since that is already overloaded with strange and awe-inspiring words.

Dr. Lindgren's classification of hypogene ore deposits, both epigenetic and syngenetic, is of course eminently scientific, flexible enough for clear thinking and adaptable to pedagogical needs; but the reviewer is at times tempted to lese majesty, in questioning the practical utility of a classification of this sort. It is based presumably on the supposition that certain ore minerals and their associates originate under definite conditions of temperature, pressure, and depth, and that such minerals may be grouped in assemblages that are roughly arranged in "depth zones" according to the temperatures and pressures existant when they were deposited. The difficulty lies in the cosmopolitan character of many of the ore minerals, which sometimes makes for strange bedfellows, since "mesothermal" and even "hypothermal" minerals may be found in comfortable companionship with the minerals of an "epithermal" deposit, with no evidence of more than one general period of mineralization. Dr. Lindgren realizes this, of course, for he says, "The merging of the various types makes it difficult to establish a rigid classification" (page 526). We will have to ascribe this mixing to "primary overlap" and let it go at that.

It is very evident that the book has been carefully revised and in places entirely reconstructed, and it is clear that very little in the literature has escaped scrutiny. It is the best book on ore deposits in the English language; indeed, in the opinion of the reviewer, it is the best book in print on that subject.

R. J. COLONY.

MECHANICAL DRAFTING HANDBOOK. By Frank R. Kepler. Bruce Publishing Co., Milwaukee, Wis. Pp. 127. Price 60c.

THIS BOOK is intended to provide students and mechanical draftsmen with a collection of essential usages, standards, conventions, and tables based upon modern practice. Part I deals with the fundamental principles of mechanical drawing and lettering. It also describes the use and care of instruments and other details. Part II treats the subject of standards and conventions. Sample drawings are provided. Liberal descriptive material is furnished as to laying out sheets, dimensions, notes, sections, and related factors. Part III concerns itself with screws, nuts, cap drills and the like.

REFRACTORIES — The American Refractories Institute, Oliver Building, Pittsburgh, Pa., has issued a bulletin entitled "Some Refractories Which Are in a Developmental Stage." The author is G. A. Bole. Among the topics treated are aluminous refractories; cyanite as an insulating material; dolomite refractories—monolithic linings; and chrome-diaspore. This bulletin contains thirteen pages and costs 50c.

DRIFTING—Reports of Investigations No. 2855, issued by the U. S. Bureau of Mines, is a paper entitled "Chambering Cut-Holes of Drift Rounds in a Western Metal Mine," by E. D. Gardner. The practice of chambering holes in standard drift rounds, which has been used to advantage at the Commonwealth mine at Pearce, Ariz., is described by Mr. Gardner.

GOLD IN NEW GUINEA—Four pages of the Feb. 6 issue of *Chemical Engineering and Mining Review*, of Melbourne, Australia, are devoted to a description of the Bulolo gold field in New Guinea. This area was discovered in 1923. The gold is in alluvial form.

FULLER'S EARTH—Report of Investigations No. 15, entitled "Preliminary Report on Fuller's Earth Deposits of Pulaski County," by J. E. Lamar, will soon be issued by the Illinois Geological Survey at Urbana. Price 50c.

BRAZIL—The annual report of the director of the Geological and Mineralogical Survey of Brazil for 1926 has been received. It contains 90 pages and, of course, is written in Portuguese.

EXPERIMENT STATIONS—U. S. Bureau of Mines Information Circular No. 6060, by A. C. Fieldner and A. H. Emery, discusses the work of the experiment stations of the Bureau. It comprises 29 pages.

SAFETY — Information Circular No. 6059, issued by the U. S. Bureau of Mines, is entitled "Accident Prevention Measures at the Moctezuma Copper Company." E. D. Gardner is the author. Four pages.

Personal Notes

Colonel H. F. OSLER has been elected president of the Manitoba Chamber of Mines.

FRANK M. ESTES, mining engineer, of La Dura, Mexico, is in New York City on a short business trip.

E. A. EMMETT, mining engineer of the Elbof Survey Organization, arrived recently in Sydney, Australia.

HENRY P. SMITH, general manager of the Guanajuato Reduction & Mines Company, is now in South Pasadena, Calif.

G. HILDRICK SMITH, who recently returned to the Transvaal from Spain, will resume the management of Nourse Mines, Ltd.

HARLOWE HARDINGE returned to New York from France on April 24 with Mrs. Hardinge. They had been gone since December.

O. J. EGGLESTON succeeds G. W. METCALFE as general manager of the Alaskan properties of U. S. Smelting, Refining & Mining.

E. C. ANDREWS, government geologist of New South Wales, has returned to Australia after his trip through Great Britain, Canada, and the United States.

DR. RUDOLPH KRAHMANN, after a visit to New Zealand, is in Queensland, Australia, making a preliminary inspection for geophysical purposes in that state.

G. T. DUVALL has returned to the United States from Bolivia, where he was connected with the Caracoles Tin Company. Mr. Duvall is now in Sioux Falls, S. D.

H. HART PRATLEY, Utah mining engineer, is spending some time in research and geophysical study under Dr. C. A. HEILAND, of the Colorado School of Mines.

A. A. HOLLAND, mining engineer of New York, is in charge of the operations of the Creighton Fairbanks Mines, Ltd., which has holdings in the Sudbury district of northern Ontario.

E. W. BEDFORD has resigned his position as resident manager of the Nevada properties of the World Exploration Company and will devote his time to a private enterprise in the Tonopah district.

W. M. FERRY, vice-president and managing director of the Silver King Coalition Mines Company, was in New York last week for the sessions of the American Silver Producers' Association, of which he is president.

T. A. RICKARD, contributing editor of *Engineering and Mining Journal*, recently addressed the Department of Mines and Mining of the Sacramento Chamber of Commerce. He dealt mainly with the history of copper.

ALFRED TELLAM, of the General Engineering Company, will leave Salt Lake City on May 10 for Peru, to supervise the construction and operation of a flotation plant that the company will erect there for the Vanadium Corporation of America.

CHARLES WILLS WRIGHT has been appointed chief engineer of the mining division of the U. S. Bureau of Mines. He fills the place which was occupied until a few months ago by M. VAN SICLEN. The work of the division deals with mining problems the main objective of which is other than safety. Such matters as mining methods, geophysical prospecting, and ventilation come under this division. Mr. Wright recently returned to this country after eighteen years of operating experience in Italy, where he was in charge of important lead and zinc mines. He introduced American mining methods in Sardinia. During the war he was in charge of the work of the American Red Cross in that province. Although a native of Marquette, Mich., Mr. Wright obtained most of his technical education in Germany. After completing his work there, he attended the Michigan College of Mining and Technology. He has served with the Canadian Geological Survey, and was connected with the U. S. Geological Survey for a number of years.

C. W. WRIGHT

E. J. WAY, formerly manager and consulting engineer of the New Kleinfontein, in the eastern Witwatersrand, is now general manager of the Ariston Gold Mines, at Prestea, in West Africa. A crushing plant is being erected under his supervision.

J. S. KINNEAR has been appointed manager of Nevada Consolidated, succeeding C. B. LAKENAN, who resigned recently. Mr. Kinnear had been acting as manager since Mr. Lakenan left on a tour of the world about a year ago. Mr. Kinnear has risen from smelter hand to manager with the company.

A. B. YOUNG, assistant manager of the International Smelting Company, is returning from New York to Salt Lake City to resume his duties with the company. During the last six months Mr. Young has been engaged on consulting work for the Cerro de Pasco Copper Corporation.

J. E. HAMMELL, president of Northern Aërial Minerals Exploration and of Howey Gold, recently visited New York to obtain fifteen airplanes for the Northern Aërial Company, which intends to provide Canadian prospectors with the means for exploration from the air and also to transport supplies to isolated mining camps.

E. PAM, manager of the Modder East mine, has accepted a position in England as consultant to the Mond Nickel Company. He will leave Johannesburg in May. M. O. TILLARD, manager of Village Deep, will succeed Mr. Pam at the Modder East and will, in turn, be succeeded by W. C. COE, at present assistant manager of City Deep.

Dr. T. L. GLEDHILL, of the Ontario Department of Mines, will examine the Boston Creek area, in northern Ontario, and F. F. OSBORNE will examine the zinc and lead deposits in the townships of Hess, Moncrief, and Craig. These examinations are part of the program of the department for the coming season for the investigation of areas in which discoveries have been made.

H. C. BACORN, vice-president and general manager of the Jardine Mining Company, Jardine, Mont., has been spending a couple of weeks in the East, at Wheeling, W. Va., and in New York. There is a good possibility that operations at Jardine may be resumed soon, if metallurgical problems in the treatment of the arsenical gold ore can be worked out so that profitable operation is assured.

J. BURNS READ, mining engineer of Golden, Colo., was appointed professor of mining at the Colorado School of Mines on April 7. Professor Read is a graduate of the South Dakota School of Mines. He was assistant professor of mining at the Case School of Applied Science at Cleveland, Ohio, and associate professor of mining at the University of Illinois. In 1920 he was made assistant manager of the Metals Exploration Company. He succeeds Dean L. S. GRANT, who resigned recently.

OBITUARY

J. E. HAMMOND, at one time connected with American Smelting & Refining, died at Brush, Colo., on April 18.

J. B. CAMMANN, mineral inspector for the U. S. Forestry Service, died at Denver, Colo., on April 15. He was 58 years old.

CARL SHERRITT, the prospector who staked the now famous Sherritt-Gordon mine, in the Cold Lake district of northern Manitoba, was killed on April 20 when a plane he was piloting crashed near The Pas, Manitoba. Mr. Sherritt was leaving on a flight into the mining districts north of The Pas when the accident occurred.

Market and Financial News

April Dividends at Normal Rate

By Homar L. Johnson
Editorial Staff

DIVIDENDS distributed by mining companies in April were even above normal, and it appears that the reflection of the prevailing low prices for the major non-ferrous metals is to be postponed again. The total of dividend payments for April compares with the four preceding corresponding quarter months as follows:

April, 1927	$16,765,500	
July, 1927	18,901,426	Average
October, 1927	13,910,750	$17,516,059
January, 1928	20,486,560	
April, 1928	18,256,890	

The foregoing table gives a fairly clear picture of the relative situation. The average for the four preceding quarter months was exceeded by this month's figure by $740,831. Large disbursements in January and July by companies paying dividends on a semi-annual basis, such as Consolidated M. & S. and Mining Corporation of Canada, were offset by the Great Northern Iron Ore dividend and others.

Comparing the list of actual payments with those for January, it is particularly noticeable that most of the distributions are running very much on schedule. Arizona Commercial, Consolidated M. & S., and Mining Corporation of Canada contributed semi-annual payments, amounting to nearly $4,000,000 in the aggregate, to swell the January total. Homestake Mining paid a bonus of $1 per share, also, that aided in boosting the January total above the twenty-million-dollar mark. Tonopah Mining is a semi-annual dividend payer that appears in April. Lucky Tiger-Combination continues its monthly payment of 7c. per share, after an increase of 2c. per share effective in February. Bingham Mines returned to its $1 per share quarterly payment after a recession to 75c. in the first quarter of 1928. Plutus, a Utah silver-lead producer, announces its regular quarterly payment of 10c. per share, following a 20c. special disbursement in December.

Annual dividend payments of Copper Range and St. Mary's Mineral Land, Michigan companies, were welcome additions to this month's total. United Gold Mines, San Francisco Mines of Mexico, and Santa Gertrudis were irregulars appearing on the January list that are absent in April. However, Rico Argentine Mining, a complex-ore producer in the Rico district, Colorado, reports an initial dividend of 3c. per share this month. Tintic Standard's January payment was a holdover from December. The April, 1927, list showed only three companies that are not included this year: Isle Royale Copper, Erupcion, and Success Mining. Isle Royale Copper appeared as an irregular, but has subsequently become a steady September and March, semi-annual, disburser. The Success Mining dividend wound up the affairs of that company. Erupcion's ore is probably about gone. Its property is surrounded by Ahumada.

All in all, it would appear that many of the large companies have been enabled to continue their dividend rates, in the face of lower metal prices, by greater economy and reduction of operating costs, and by drawing upon reserve funds built up, for just such a purpose, in times of higher metal prices and wider profit margins.

E. & M. J. Compilation of Mining Dividends and Yields for April, 1928

Companies in the United States	Situation	Per Share	Total	Per Cent Annual Yield
Aluminum Co. of America, pfd	Various	$1.50 Q	$2,214,930	5.5
Bethlehem Steel, pfd	Various	1.75 Q	1,697,500	5.9
Bingham Mines, s,l	Utah	1.00 Q	50,000	7.2
Bunker Hill & Sullivan, l,s	Idaho	0.75 MX	234,250	6.4
Cleveland-Cliffs Iron	Mich.	1.00 Q	400,000	3.5
Copper Range, c	Mich.	1.00 A	394,693	6.2
Cresson Consolidated Gold	Colo.	0.10 Q	122,000	24.6
Eagle-Picher Lead, pfd., l,z	Okla., Mo.	1.50 Q	12,769	5.7
Great Northern Iron Ore	Minn.	0.75	1,125,000	j6.5
Homestake Mining, g	S. D.	0.50 M	125,580	j9.7
Inland Steel, pfd	Minn.	1.75 Q	175,000	6.1
Kennecott Copper	Alaska	1.25 Q	5,623,022	5.9
Magma Copper, c,s	Ariz.	0.75 Q	306,116	6.1
Newmont Mining, h	Various	1.00 Q	452,760	j2.1
Nichols Copper, pfd	N. Y.	1.75 Q	40,247	....
Park Utah Consolidated, s,l,z	Utah	0.20 Q	418,700	7.3
Phelps Dodge, c	Various	1.50 Q	750,000	4.6
Plutus, s,l	Utah	0.10 Q	99,715	15.9
Republic Iron & Steel, pfd	Various	1.75 Q	437,500	6.5
Rico Argentine Mining, s,l,z	Colo.	0.03 I	23,000	....
Silver King Coalition, s,l	Utah	0.25 Q	304,025	j9.8
Sloss-Sheffield Steel & Iron, pfd	Ala.	1.75 Q	117,250	5.9
St. Mary's Mineral Land, h	Mich.	2.00 A	320,000	7.8
Tonopah Mining, s	Nev.	0.075 SA	75,000	3.6
U. S. Smelting, Refining & Mining, s,l	Various	0.875 Q	306,350	8.4
U. S. Smelting, Refining & Mining, pfd	Various	0.875 Q	425,557	6.6
Companies in other countries:				
Asbestos Corporation, pfd	Quebec	1.75 Q	130,482	7.5
Dome Mines, g	Ont.	0.25 Q	238,333	9.2
Hollinger Consolidated Gold	Ont.	0.10 4 wks.	492,000	7.7
Howe Sound, s,c,l	B. C., Mex.	1.00 Q	496,038	7.7
Lucky Tiger-Combination, g,s	Sonora	0.07 MY	50,073	j8.4
Nipissing, s	Ont.	0.075 Q	90,000	6.9
N. Y. & Honduras Rosario, g,s	Honduras	0.50QX	100,000	11.7
Patino Mines & Ent., t	Bolivia	4s.	£276,063	....
Premier Gold, s,g	B. C.	0.08 Q	$400,000	6.8
Total			$18,256,890	

s, silver; l, lead; z, zinc; g, gold; c, copper; h, holding; A, annual; Q, quarterly; M, monthly; X, extra; QX, $0.25 regular and $0.25 extra; SA, semi-annually; SAB, semi-annual, $1.25, bonus $5; MX, monthly 25c., extra 50c.; MY, monthly 5c., extra 2c.; I, initial; j, based on dividends for the last twelve months.

Magma Copper Earnings Lower in 1927

The Magma Copper Company, operating in the Superior district of Arizona, produced during 1927 from its Magma mine 221,855 tons of ore averaging 6.61 per cent copper, 3.44 oz. silver, and 0.031 oz. gold. Operations were continuous throughout the year except for sixteen days' forced shutdown after the mine fire that started in the No. 2 shaft.

The consolidated net income for the year was $825,045, against $1,210,520 in 1926. Total smelter production of copper amounted to 28,502,521 lb. Of this total 977,020 lb. of copper was from custom ores. Average cost of producing company's copper was 8.604c. per lb., with gold and silver credited to copper and after all charges except depreciation and Federal taxes.

Consolidated Income and Expense Statement for the Year 1927

Sales of copper			$3,786,495
Cost of sales:			
Inventory of metals, ores and concentrates, Jan. 1, 1927	$1,276,104		
Operating expenses	$2,862,126		
Depreciation	389,971		
State and county taxes	259,867		
	$3,511,965		
Less—gold and silver sales	717,466	2,794,498	
		$4,070,603	
Inventory of metals, ores and concentrates, Dec. 31, 1927		$1,191,044	$2,879,558
			$906,936
General, administrative and engineering expenses			75,944
			$830,992
Interest and other income			58,821
			$889,813
Railroad income		$128,149	
Railroad operating expense	$99,184		
Depreciation—roadway and equipment	42,359	141,543	13,393
			$876,419
Other deductions			
Stock underwriting commissions and expenses			51,375
Net gain for the year			$825,044
Consolidated Surplus Account			
Balance Jan. 1, 1927			$775,511
Add			
Net gain for the year 1927	$825,044		
Unclaimed wages	784		825,829
			$1,601,340
Deduct			
Adjustment account previous years' taxes			26,154
			$1,575,186
Deduct			
Dividends declared in year 1927, Nos. 22, 23, 24 and 25			1,224,465
Balance—Dec. 31, 1927			$350,721

Phelps Dodge Profits Affected by Low Metal Prices in 1927

PHELPS DODGE CORPORATION operations recorded a net loss of $1,199,098 for 1927, after deducting $4,822,680 for depletion. This compares with a net loss of $947,598 in 1926, after deducting $5,817,264 for depletion. Consolidated income accounts for 1927, 1926 and 1925 compare as follows:

	1927	1926	1925
Gross income	$32,985,490	$38,424,038	$39,707,084
Expenses	27,455,027	31,175,849	31,753,604
Interest	.....	.....	428,429
Depreciation	1,906,881	2,378,523	2,467,046
Profit	$3,623,582	$4,869,666	$5,058,005
Depletion	4,822,680	5,817,264	6,211,686
Net loss	$1,199,098	$947,598	$1,153,681
Dividends	3,000,000	2,750,000	2,000,000
Deficit	$4,199,098	$3,697,598	$3,153,681
Contingent reserve	1,350,000	.....	.....
Previous surplus	74,087,254	77,784,852	80,938,533
Profit-and-loss surplus	$68,538,156	$74,087,254	$77,784,852

Consolidated balance sheet as of Dec. 31, 1927, shows assets and liabilities as follows:

Assets

Fixed		
Mines and mining claims	$160,830,539	
Buildings, plants, and equipment	38,354,851	
Investments in sundry companies	889,916	
		$200,076,307
Current		
Stripping and prepaid expense Sacramento Hill being currently charged mining operations	$3,126,893	
Supplies, material and miscellaneous prepaid expenses	2,028,586	
Metals in process and on hand — copper and lead at cost, silver and gold at market	7,027,389	
Merchandise (Phelps Dodge Mercantile Co.)	1,007,637	
Accounts receivable	4,216,107	
Marketable securities	1,405,911	
Cash and call loans	9,400,636	
		28,213,162
Marketable securities held against reserves		540,190
Total		$228,829,660

Liabilities

Capital		
Capital stock—authorized and issued—500,000 shares at $100 each		$50,000,000
Current		
Accounts payable and taxes accrued	$5,357,907	
Dividend payable Jan. 3, 1928	750,000	6,107,907
Reserves		
For depletion	$76,865,308	
For depreciation	24,537,796	
Miscellaneous — fire insurance, pensions and contingencies	2,780,491	104,183,595
Surplus		
Balance Dec. 31, 1926	$74,087,254	
Transfer to reserve for contingencies	1,350,000	
	$72,737,254	
Income before depletion, for the year 1927—per income account	3,623,581	
	$76,360,836	
Deduct depletion for the year 1927	4,822,679	
	$71,538,156	
Dividends declared	3,000,000	68,538,156
		$228,829,660

President Walter Douglas states in his report that development of new ore in 1927 did not keep up with extraction, although production at both sections of the Copper Queen branch was less than in 1926. Sinking of the Warren shaft below the 1,800 level awaits completion of the high-pressure grouting of the shaft walls to shut off the heavy flow of water.

Phelps Dodge Production Data

Company ores	1927	1926
Copper, lb.	184,858,377	197,849,933
Lead, lb.	2,241,256	4,212,054
Silver, oz.	1,226,223	1,470,523
Gold, oz.	37,160	43,756
Manganese, lb.	3,288,162	.....
Custom ores		
Copper, lb.	3,322,533	2,028,665
Silver, oz.	619,413	221,708
Gold, oz.	6,258	6,520

Wright-Hargreaves Mines, Ltd., Earned $1,068,180 Net in 1927

WRIGHT-HARGREAVES Mines, Ltd., operating in the Kirkland Lake district of Canada, reports net earnings of $1,068,180 in 1927, against $1,392,746 in 1926. Profit-and-loss statement for 1927 follows:

Bullion Production		$2,151,916
Operating Costs		
Development and exploration	$236,560	
Stoping	263,595	
	$500,156	
Transporting ore	182,933	
Milling charges	241,336	
Market bullion	14,890	
New road construction and general surface	11,366	
Stock transfer and registrar charges	19,056	
General and undistributed charges	99,887	
Depreciation plant and equipment	74,427	1,144,054
From Operation		$1,007,861
Other Income		
Exchange	477	
Interest	45,359	
Rent, cottage operation	4,641	
Purchase discounts earned	1,860	
Miscellaneous	7,979	60,318
Net to Surplus		$1,068,180

Dividend disbursements amounting to $1,237,500 were made. Average daily tonnage milled was 572, an appreciable increase over the corresponding daily average figure for 1926. Grade of ore was lower than had been anticipated. Additions to the milling plant have been made which will permit the treatment of 750 tons per day in 1928.

Bunker Hill & Sullivan Established Production Record in 1927

The Bunker Hill & Sullivan Mining & Concentrating Company produced 94,971,072 lb. of lead and 1,799,892 oz. of silver from its properties in the Coeur d'Alene district, Idaho, in 1927. This production exceeds by a considerable margin that of any other year during the company's 41 years of operation. In spite of the large production, net operating profit, before depletion, dropped from $2,858,683 in 1926 to $2,567,189 in 1927. Ore reserves at end of 1927 compare with those at end of 1926 as follows:

	Short Tons 1927	Short Tons 1926
Sullivan mine	183,879	178,040
Bunker Hill mine	2,824,763	3,711,400
Total	3,008,642	3,889,440

Reserves at the end of 1927 are sufficient to assure seven years of operation on the basis maintained in 1927. Mining costs during the year averaged $3.73 a ton; concentration, 96c. per ton; all other costs, 35c. per ton.

Payment for the Star mine was completed during the year and title was taken by the Sullivan Mining Company, which is owned jointly by the Bunker Hill & Sullivan and the Hecla Mining Company. Production of zinc concentrates was discontinued in April, 1927, but will be resumed in the near future with the completion of the Sullivan electrolytic zinc plant at Silver King, near the Bunker Hill smelter. The income account is tabulated as follows:

Revenue

Production revenue	$6,932,271
Production and marketing costs	4,365,082
Operating profit before depletion	$2,567,189
Other revenue, after income taxes	789,961
Operating surplus before depletion	$3,357,150
Deduct depletion of revenues in 1927	698,164
Proportion charged normal surplus	$131,681
Proportion charged revaluation surplus	566,483
Operating surplus after depletion	2,658,987
Dividends paid in 1927	2,993,628
Common	$2,943,000
Preferred	50,628
Deficit to profit-and-loss surplus	$234,641

Ore mined and milled for the last three years compares as follows: 1927, 456,134 tons; 1926, 459,761 tons; 1925, 453,412 tons.

Credit for the larger metal production in 1927 as compared with the decreased tonnage of ore treated is attributed to increases in metallurgical efficiency and the treatment of higher-grade ore.

Tintic Standard Earns Less in 1927

TINTIC STANDARD Mining Company, operating in the Tintic district of Utah, curtailed production in 1927 because of the prevailing low prices of lead and silver. The result is a decrease in net earnings from $2,688,359 in 1926 to $1,824,497 in 1927. Ore reserves increased during the year, although definite figures were not published.

Metal Production in 1927

Gold, oz.	5,861
Silver, oz.	3,295,086
Lead, lb.	43,687,436
Copper, lb.	742,783
Bismuth, lb.	10,010

Development work to the extent of 15,405 ft. of drifting, 2,783 ft. of raises, and 254 ft. of sinking was carried out during the year in the Tintic Standard and Iron Blossom properties. In the Tintic Standard, one new deposit was opened up near the No. 2 shaft on the 800 level, adding to the ore reserves a large tonnage of medium-grade ore.

The Market Report

Copper and Zinc Markets Stiffen

New York, April 25, 1928—A moderate volume of business, with a firmer tendency in prices for copper and zinc, characterized a featureless week in the non-ferrous metal markets. More sales of copper are reported than for three weeks, and since Monday there has been decidedly less tendency to shade the 14.25c., Connecticut, price asked by the primary producers. The sellers of zinc have not pressed metal on the market, and were able to realize slightly higher prices for the modest tonnage traded in. Today the price seems firm at 5.80c. Lead is steady at 6.10c. New York and 6c. St. Louis; and tin, after a slight sag, is back in the neighborhood of 52⅛c. for prompt Straits. Silver on April 24 reached 57¾c. Antimony, quicksilver, and platinum group metals, unchanged.

Daily Prices of Metals

April	Electrolytic Copper	Straits Tin	Lead		Zinc
	Refinery	New York	New York	St. Louis	St. Louis
19	13.90 @14.025	52.00	6.10	6.00	5.75
20	13 925@14.025	52.00	6.10	6.00	5.75@5.775
21	13.925@14.025	52.00	6.10	6.00	5.775
23	13.975@14.025	51.875	6.10	5.975@6.00	5.80
24	13.975@14.025	52.375	6.10	6 00	5.80
25	13.975@14.025	52.125	6.10	6.00	5.80
	13.985	52.063	6.100	5.998	5.781

Average prices for calendar week ending April 21, 1928, are: Copper, 13.977; Straits tin, 52.229; N. Y. lead, 6.100; St. Louis lead, 6.000; zinc, 5.756; and silver, 57.396.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis; that is, delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted, and prices at so-called Middle West destinations, 0.325c. above.

Quotations for copper are for the ordinary form of wire bars and ingot bars. For ingots an extra 0.05c. per pound is charged; for slabs, 0.075c.; and for cakes, 0.125c. up, depending on weight. Cathodes are sold at a discount of 0.125c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

April	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3M	Spot	3M	Spot	3M
	Spot	3M							
19	61⅝	61 11/16	66½	234⅜	233¾	20 7/16	20⅝	25¾	25½
20	61⅝	61¾	66½	234⅝	234⅛	20 11/16	20 11/16	25 13/16	25 11/16
23	61½	61 11/16	66½	232½	232½	20 13/16	20 13/16	26	25⅝
24	61 11/16	61⅞	66½	233½	233⅜	20 13/16	20⅞	26⅛	26
25	61⅝	61 13/16	66½	233¼	233⅝	20⅞	20 11/16	26 1/16	25 13/16

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

April	Sterling Exchange "Checks"	Silver		Gold London	April	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
19	4.87 13/16	57½	26 7/16	84s11¼d	23	4.87 13/16	57⅝	26 7/16	84s10d
20	4.87⅜	57¾	26 5/16	84s11¼d	24	4.87⅜	57¾	26⅜	84s11d
21	4.87 13/16	57⅜	26⅜	.....	25	4.87 11/16	57⅝	26 9/16	84s11d
					Avg.		57.542		

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command three-eighths cent premium.

Fair Week in Copper

Sales of copper during the week ending today were in fair volume, a situation that comes as a surprise to many of those in close touch with the market, who had expected a very quiet week. The price is somewhat firmer today, after a close-to-average sales week. Except for one or two sales, all of the business today was at the full 14.25c. level, and the tonnage of metal available at prices below that level is considerably less than it was a week ago. Sales were generally for prompt and May shipment, with a small proportion of the tonnage for June delivery. Foreign sales have been large, with improved business conditions abroad, and are expected to be even better on the Continent, after the French elections. The Exporters' price is unchanged at 14.50c. c.i.f. Statistics for March were not as decisive as had been expected, although the rate of world production showed a considerable decrease.

Moderate Activity in Lead

Though business cannot be described as active, consumers bought lead in fair volume each day during the week ending today. A moderate tonnage in the Middle West changed hands at small concessions from the 6c. level maintained by the leading interest. In the New York market virtually all of the business was done at 6.10c., which also has been the contract price of the American Smelting & Refining Company. The narrow margin between the price in the St. Louis and New York markets suggests either that New York should go up or that prices should weaken in the Middle West. However, the supplies available in the St. Louis market, as well as in Chicago, are limited, and sellers appear reluctant to cut under the 6c. price. On the other hand, plenty of metal is obtainable in the East, and unless London should take a decidedly firmer stand, it hardly seems likely that the price will be advanced in New York. Most of the business of the current week was for prompt or May delivery, with small consumers as well as large ones among the buyers. Although the A.B.M.S. statistics of smelter production do not disclose the fact, an important reduction in mine output appears to have taken place in the Rocky Mountain states as well as in southwest Missouri. Smelter intake in Idaho has been at a lower rate for some time, and the plants in Salt Lake Valley are now on a sharply curtailed production basis. These facts help explain the comparative smallness of the offerings in the Middle West market. Taken all in all, sentiment among sellers may be described as ranging from extremely hopeful to moderately optimistic.

Zinc at Higher Price Levels

Sales of Prime Western zinc have been in fair volume, and the tone of the market is stronger. All sales since the week end have been at 5.80c., with future metal slightly higher. The prevailing price at the beginning of the *E. & M. J*

week was 5.75c., and the larger part of the sales reported was at that figure. The situation in the Tri-State district appears as improved, although production statistics are far from satisfactory.

Correction: Owing to an error in cables from abroad, the quotation for three-month's zinc in London on March 5 was published in the *E. & M. J.* as £25⅛. The correct figure was £24⅞, and the correct average for the month of March is £24.960.

Tin Down and Up

Tin prices sagged during the week in the domestic market, but closed only a little lower than a week ago. Except on Tuesday, the market has been quiet, with traders the dominant buyers. Support by operators in London advanced the price there, and this improved sentiment in New York sufficiently to stiffen prices. In London, spot and future are virtually on a par, and in New York spot commands a slight premium, indicating that the outlook for the future trend of the price is not considered good. Scattering sales of tin of 99 per cent grade have been made at about one cent under the price for Straits, and of English refined, 99.75 per cent, about ⅛c. under Straits. Deliveries to American consumers this month will, it is estimated, be about 7,000 tons, which is somewhat below the unusually heavy shipments of March.

Slight Decline in Foreign Exchange

A small net decline is noted in the foreign exchanges, sterling reaching a lower point than for several weeks. Closing cable quotations on Tuesday, April 24, were as follows: francs, 3.93⅛c.; lire, 5.27c.; and marks, 23.91½c. Canadian dollars are at 1/128 per cent premium.

Silver Holds Gain and Closes Steady

Silver continued its recent hesitating course during the last week, the tendency appearing, however, to be toward slightly higher levels. On the 24th, buying by China raised prices to 26⅝d. in London and 57⅛c. in New York, the latter rate being within ⅛c. of the high for the year, touched on Jan. 5. The immediate trend is obscure, but the market is steady.

Mexican Dollars (Old Mexican pesos): April 19th, 44⅛c.; 20th, 21st, and 23d, 44c.; 24th, 44⅜c., 25th, 44¼c.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

ALUMINUM—Per lb., 98 or 99 per cent grades, price of leading interest, 24.30c.; outside market, 23.90@24.30c.

ANTIMONY—Per lb., duty paid. New York: Chinese brands, for all positions, 10c. Market stronger.

Cookson's "C" grade, spot, 15⅜c. Needle antimony nominally 7¼c. for lump and 10c. for powdered. White oxide, Chinese, 99 per cent Sb_2O_3, 11¼c.

BISMUTH—Per lb., New York, in ton lots, $2.10. Smaller lots, $2.25 and up.

IRIDIUM — Per oz., $275@$300 for 98@99 per cent sponge and powder. Market dull, prices largely nominal.

NICKEL—Per lb. ingot, 35c.; shot, 36c.; electrolytic, 37c. (99.9 per cent grade) for single lots of spot metal.

PALLADIUM — Per oz., $46@$49. Small lots bring up to $55. Absolutely no activity in market.

PLATINUM—Official price quoted by the leading interest on small miscellaneous orders for refined metal, per oz., $80. Dealers and refiners quote the trade for refined metal, per oz., cash, for wholesale lots, $74 bid, $76@$77 asked. Market dull.

QUICKSILVER — Per 76-lb. flask, $123.50@$124.50, depending on quantity. Market firm. San Francisco wires $122.33.

Prices of Cadmium, Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Monel Metal, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Tungsten, and Zirconium are unchanged from the issue of April 7.

Metallic Ores

MANGANESE ORE—Per long ton unit of Mn, c.i.f. North Atlantic ports, minimum 47 per cent Mn: 35@38c. Caucasian, washed, 53@55 per cent, 38@40c. Chemical grades unchanged from quotations in the April 7 issue.

TUNGSTEN ORE—Per unit of WO_3, N. Y.; Wolframite, $10.50@$10.60. Western scheelite, $10.50@$10.75. Prices nominal.

Chrome, Iron, Tantalum, and Titanium ores are unchanged from quotations in the April 7 issue.

Joplin Zinc Producers Hesitate to Sell at $38

Joplin, Mo., April 21, 1928

Blende	Per Ton
High	$40.30
Premium blende, basis 60 per cent zinc	$39.00@ 40.00
Prime Western, basis 60 per cent zinc	38.00
Fines and slimes, 60 per cent zinc	35.00@ 37.00
Average settling price, all zinc	37.05
Galena	
High	$78.70
Basis 80 per cent lead	77.50
Average settling price, all lead	76.45

Shipments for the week: Blende, 15,836; lead, 2,354 tons. Value, all ore the week, $766,650.

Last week sellers were freely offering zinc concentrate on a $38 basis, and buyers accepted their offerings to a total of 20,900 tons. This week buyers were seeking to contract a similar tonnage, but sellers were accepting offers in only a limited way.

One company disposed of 2,000 tons of reserve lead and about the same tonnage was sold from reserve stock by other companies.

Platteville, Wis., April 21, 1928.

Zinc Blende	Per Ton
Blende, basis 60 per cent	$40.75
Lead Ore	
Lead, basis 80 per cent lead	$77.50

Shipments for the week: Blende 840 tons; lead 40 tons. Shipments for the year: Blende 11,805 tons; lead 680 tons. Shipments for the week to separating plants: 1,745 tons blende.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystal, Silica, Spodumene, Sulphur, Talc, Tripoli, and Zircon are unchanged from prices in the April 7 issue.

Metallic Compounds

ARSENIOUS OXIDE (White Arsenic)—Per lb., 4c. Market quiet.

Calcium Molybdate, Copper Sulphate, Sodium Sulphate (Salt Cake), Sodium Nitrate, and Zinc Oxide are unchanged from prices in the April 7 issue.

Ferro-Alloys

FERROMANGANESE—Per long ton, domestic and foreign, f.o.b. furnace or duty paid, port of entry, $100 quoted for second quarter, 1928. Spiegeleisen, 19@21 per cent, $32 f.o.b. furnace.

FERROTUNGSTEN—Per lb. of W contained, 75@80 per cent, 92@95c. f.o.b. works.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrophosphorus, Ferrosilicon, Ferrotitanium, and Ferrovanadium are unchanged from prices in the April 7 issue.

Metal Products

Rolled Copper, Lead Sheets, Nickel Silver, and Yellow (Muntz) metal are changed from prices in the April 14 issue.

ZINC SHEETS—Price advanced from 8½c. to 9c. per lb., f.o.b. works, effective April 16.

Refractories

Chrome Brick, Fireclay Brick, Magnesite Brick, Silica Brick and Zirkite are unchanged from quotations in the issue of April 7.

Iron, Steel, and Coke

Iron—Per gross ton, Valley furnaces, Bessemer, $17.50; basic, $17; No. 2 foundry, $17.25.

Steel—Base prices per gross ton, Pittsburgh, billets and slabs, $33; plates, structural shapes, and soft steel bars, per pound, 1.85@1.90c.

Coke—Per gross ton, Connellsville furnace, contract, $2.75@$3; spot, $2.60@$2.75. Connellsville foundry, contract, $3.75@$4.25; spot, $3.60@$4.25. By-product coke, Ohio and Kentucky, $7; Buffalo and Detroit, $8.50@$9.

Mining Stocks—Week Ended April 21, 1928

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	69¼	65½	66¼	Ap.14, My.21 Q	0.75
Ariz. Com'l	Boston	4	3¾	3¾	Ja. 19, Ja. 31 SA	0.25
Cal. & Ariz	New York	103¾	98	99¼	Ma. 3, Ma. 19 Q	1.50
Calumet & Hecla	Boston	21¼	21	21¼	Fe. 28, Ma. 15 Q	0.50
Cerro de Pasco	New York	70¼	67¼	67¾	Ap.12, My.1 Q	1.00
Chile Copper	New York	42¼	40	41	Ma. 2, Ma.30 Q	0.625
Con. Coppermines	N. Y. Curb	10¼	10	10¼		
Copper Range	Boston	16¼	15¼	15½	Ma. 24, Ap. 20 A	1.00
Crystal Copper	Boston Curb	*77	*74	*74		
East Butte	Boston			2	Dec., 1919	0.50
Granby Consol	New York	48¾	46¼	46¼	Ap.13, My.1 Q	1.00
Greene Cananea	New York	127½	120	121¼	Nov., 1920	0.50
Howe Sound	New York	52½	50	50½	Ma.31, Ap.16, Q	1.00
Inspiration Consol	New York	22¾	20¾	21¾	Apr. 1927 Q	0.25
Iron Cap	Boston Curb	2¾	2¾	2¾		
Isle Royale	Boston	14½	13½	14	Fe.28, Ma.15 SA	0.50
Kennecott	New York	86¾	84	84¾	Ma. 2, Ap. 2 Q	1.25
Magma Copper	New York	49¾	47¾	47¾	Ma.31, Ap.16 Q	0.75
Mason Valley	N. Y. Curb	1¼	1¼	1¼		
Miami Copper	New York	19¼	19	19¼	My.1, My.15, Q	0.37½
Mohawk	Boston	62	57	58¼	Ap. 30, Jn. 1 Q	1.00
Montana-Idaho	Spokane			*39¾		
Mother Lode Coal	New York	3¼	3	3¼	De.16, De.31 SA	0.25
Nevada Consol	New York	21¼	20¼	20¼	Ma.16, Ma.31 Q	0.375
New Cornelia	Boston	28	28	28	My. 4, My. 21 Q	0.50
Noranda	N. Y. Curb	17¾	17½	17½		
North Butte	Boston	2¼	2	2¼	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	*85	*76	*79	Sept., 1926	0.03
Old Dominion	Boston	10¼	10¼	10¼	Dec., 1918	1.00
Phelps Dodge	N. Y. Curb	132½	129	129	Ma.20, Ap.2 Q	1.50
Quincy	Boston	12¾	12¼	12¼	March, 1920	1.00
St. Mary's Min. Ld	Boston	25¾	24	25	Ap.1928 A	2.00
Seneca Copper	New York	3	2¾	2¾		
Shattuck-Denn	N. Y. Curb	19	17¾	17¾		
Tenn. C. & C	New York	13¼	11¼	13	Fe.29, Ma.15,Q	0.12½
United Verde Ex	N. Y. Curb	19¾	18	18¾	Ap.6, My.1, Q	0.50
Utah Copper	New York			150	Ma.16, Ma.31 Q	1.50
Utah Metal & T	Boston	1¼	1¼	1¼	Dec., 1917	0.30
Walker Mining	Salt Lake	*94	*80	*87		
NICKEL-COPPER						
Internat. Nickel	New York	90½	85	85	Ma.15, Ma.31Q	0.50
Internat. Nickel pfd	New York	115	115	115	Ap.12, My.1 Q	1.50
LEAD						
Gladstone Mtn	Spokane	*7¼	*5½	*7¼	June, 1927	0.005
National Lead	New York	131¼	128	128	Ma.16, Ma.31Q	1.25
National Lead, pfd. A	New York			147	Ju.1, Ju.15 Q	1.75
National Lead, pfd. B	New York			120	Ap.23, My.1 Q	1.50
St. Joseph Lead	New York	40¼	39	39¼	Jn.9, Jn.20, QX	0.75
ZINC						
Am. Z. L. & S	New York	28½	23½	25¼	May, 1917	1.00
Am. Z. L. & S. pfd	New York	95¾	87¾	88	Nov., 1920	1.50
Butte C. & Z	New York	7	6½	6½	De., 1926	0.50
Butte & Superior	New York	10¾	10¼	10	Ma.14, Ma.31 Q	0.50
Callahan Zn-Ld	New York	3¼	2¾	3	De., 1920	0.50
Consol.Lead&Zinc 'A'	St. Louis	12¼	12	12	Ap., 1927	0.25
Eagle-Picher	Cincinnati	17¾	16¼	17	No.15, De.1 Q	0.40
Eagle-Picher pfd	Cincinnati	103	103	103	Ma. 31, Ap. 16 Q	1.50
New Jersey Zn	N. Y. Curb	206	197½	206	Ap. 20, My. 10 Q	2.00
Treadwell-Yukon	Toronto	23	22	23		
United Zinc	N. Y. Curb			25		
Yellow Pine	Los Angeles	*25	*25	*25	Dec., 1925 Q	0.04
GOLD						
Alaska Juneau	New York	4¼	3¾	3¾		
Argonaut	Toronto	*8¼	*5	*7		
Barry-Hollinger	Toronto	1.37	1.19	1.29		
Central Manitoba	Toronto	1.34	1.25	1.29		
Con.W.Dome L. new	Toronto	*9¼	*8¾	*8¾		
Cresson Consol. G	N. Y. Curb	1¼	1¼	1¼	Ma.31, Ap.10 Q	0.10
Dome Mines	New York	10¼	9¾	10	Ma.31, Ap.20 Q	0.25
Golden Cycle	Colo.Springs	†1.75	†1.72		Fe.29, Ma.10 Q	0.04
Gold Hill	Toronto	*23¼	*17	*22¼		
Hollinger Consol	Toronto	16.70	15.30	16.00	Ap.4, Ap.21	0.10
Homestake Mining	New York	36	33¾	34¾	Ap.20, Ap.25 M	0.50
Kirkland Lake	Toronto	1.96	1.80	1.89		
Lake Shore	Toronto	23.75	23.00	23.10	Ma.1, Ma.15QX	0.20
McIntyre-Porcupine	New York	26¼	26	26¼	May1, Ju.1 Q	0.25
Portland	Colo.Springs	†20	†17½		Ap., 1927	0.02
Rand Mines	New York			40¾	Fe.21-28 Am.Sh.	1.52
Sylvanite	Toronto	3.25	3.20	3.22		
Teck-Hughes	Toronto	9.55	8.75	9.35	Ja. 17, Fe. 1 X	0.15
Tom Reed	Los Angeles	*32	*31½	*31½	Dec., 1926	0.02
Tough-Oakes	Toronto	*54	*45	*51		
United Eastern	N. Y. Curb	*55	*50	*55	July, 1924	0.05
Vipond Cons	Toronto	*58	*51	*58	April, 1927	0.03
Wright-Hargreaves	Toronto	4.65	4.25	4.60	Ap.13, My.1 Q	0.05
GOLD AND SILVER						
Carnegie Metals	N. Y. Curb	24¾	24¼	24¼		
Con. Cortes	N. Y. Curb	*29	*27	*29		
Dolores Esperanza	N. Y. Curb	*57	*50	*57	July, 1923	0.05
N.Y. Hond's Rosario	N. Y. Curb			17	Ap.18, Ap.28 Q	0.50
Premier Gold	N. Y. Curb	2¼	2¼	2¼	Ma 15, Ap.4	0.08
Tonopah Belmont	N. Y. Curb			1¼	Oc., 1925	0.05
Tonopah Extension	N. Y. Curb	*12	*10	*10	Ap., 1925	0.05
Tonopah Mining	N. Y. Curb	4¼	4¼	4¼	Mar.31, Ap.21 SA	0.07½
West End Consol	N. Y. Curb			*6	Mar., 1923	0.05
Yukon Gold	Boston Curb	*75	*61	*61	June, 1918	0.02
SILVER						
Beaver Consol	Toronto	1.56	1.45	1.49	May, 1920	0.03
Castle-Trethewey	Toronto	*60	*55	*56		
Coniagas	Toronto	5.40	5.00	5.40	May, 1924	0.12½
Keeley	Toronto	*58	*54	*54	Ma.1, Ma.15 SA	0.04
Lorrain Trout Lake	Toronto			*30	July, 1925	0.05
Mining Corp. Can	Toronto	3.50	3.22	3.45	Ja.10, Ja.25 SA	0.125
Nipissing	N. Y. Curb	4¼	4¼	4¼	Ma.31, Ap.20Q	0.07½

Stock	Exch.	High	Low	Last		Last Div.
SILVER-LEAD						
Ahumada	New York	4¾	4¼	4¼	Ap., 1927	0.12½
Bingham Mines	Boston	51	49¼	49¼	Ma.22, Ap.5 Q	1.00
Bunker Hill & Sullivan	N. Y. Curb	140	140	140	Ma.31, Ap.4 MX	0.75
Cardiff M. & M	Salt Lake	*74	*74	*74	Feb. 5, 1927	0.10
Chief Consol	Salt Lake	4.20	4.00	4.12½	Ja.10, Fe.1 Q	0.10
Consti'nMng.&Mill'g.	Spokane	*20	*15	*20		
Erupcion	Boston Curb			*30	Ap. Q	0.07½
Eureka Lily	Salt Lake	1.90	1.65	1.90		
Federal M. & S	New York	122	120	122	Je., 1927	10.00
Federal M. & S. pfd	New York	95¾	95	95	Fe.24, Ma.15 Q	1.75
Hecla Mining	N. Y. Curb	14¾	13¾	13¾	My.15, Jn.15 Q	0.15
Highland-Surprise	Spokane	*13	*11	*12		
Iron King Mining	Salt Lake	*63	*63	*63		
Keystone Mining	Salt Lake	*›2½	*32½	*32½	Fe., 1926	0.07½
Lucky Jim	Spokane	*›9	*39	*39		
Lucky Tiger-Com	Kansas City	†7.85	†7.50		Ap.10,Ap.20MX	0.07
Mammoth Mining	Salt Lake	†2.00	†1.50		De., 1926	0. 25
North Lily	Salt Lake	6.40	6.15	6.25		
Park Utah	New York	11	10¼	10¾	Ma.15, Ap.15 Q	0.20
Plutus Mining	Salt Lake	†2.25	†1.75		Ap.10, Ap.16	0.10
Silver King Coal	Salt Lake	11.25	11.25	11.25	Ma.20, Ap.2 Q	0.25
Silversmith	Spokane	*17	*14	*16½	Oct., 1926 Q	0.02
Strattons Mines	Spokane	*47	*45	*45		
Sunshine M. Co	Spokane	1.44	1.30	1.44	Fe.10, Fe.20	0.10
Tamarack-Custer	Spokane	*90	*87	*90	Sept., 1924	0.25
Tintic Standard	Salt Lake	13.62½	13.12½	13.25	Ma.21, Ma.29Q	0.30
Utah-Apex	Boston	4¼	4¼	4¼	Oct., 1926	0.25
IRON						
Bethlehem Steel	New York	66¾	61	61½	Jy., 1924	1.25
Cleveland-Cliffs Iron	Cleveland	119	114	115	Ap.13, Ap. 25. Q	1.00
Colorado Fuel & Iron	New York	77	72¾	73¼	May, 1921	0.75
Gt. North'n Iron Ore	New York	24¼	22¾	22¾	Ap. 9, Ap. 30 K	0.75
Inland Steel	New York	56¼	52¾	55	No. 15, De. 1 Q	0.62½
Republic I. & S	New York	63	60	60	My.15, Jn.1 Q	1.00
Republic I. & S. pfd	New York	108¼	108¼	108¼	Jn. 15, Jy. 2 Q	1.75
Sloss-Sheffield S. & I	New York	125	121¼	121¼	Ma.10, Ma.20 Q	1.50
Sloss-Snef. S.&I. pfd	New York	122½	122	122½	Ma. 20, Ap. 2 Q	1.75
U. S. Steel	New York	149¼	145¼	145¼	Fe. 29, Ma. 30 Q	1.75
U. S. Steel, pfd	New York	146¾	145¾	146¾	Fe. 4, Fe. 28 Q	1.75
Virginia I. C. & C	New York			32	Jan., 1924	1.50
Virginia I.C.&C. pfd	New York	56	56	56	De. 16, Ja. 3 SA	2.50
DIAMONDS, PLATINUM, ALUMINUM, VANADIUM, TIN						
De Beers Consol	New York			27	Jy., 1927	1.45
So. Am. G. & P. New	N. Y. Curb	3¼	3	3¼		
Alum. Co. of Amer.	N. Y. Curb	150¼	140	147		
Alum. Co. of Amer. pf.	N. Y. Curb	109¾	109	109½	Ma. 15, Ap. 1 Q	1.50
Vanadium Corp.	New York	85¾	81	81¼	My. 1, My. 15 Q	0.75
Patino M. & E	New York	32¾	30	30¼	April, 1928	4s.
ASBESTOS						
Asbestos Corp.	Montreal	33¼	32¼	33	Jan., 1926	1.50
Asbestos Corp. pfd	Montreal	94	93	93¼	Ma. 31, Ap. 16 Q	1.75
SULPHUR						
Freeport Texas	New York	83¼	77	78¼	Ap.14,Ma.1QX	1.75
Texas Gulf	New York	76½	73¼	73¼	Ma. 1, Ma. 15 Q	1.00
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	44¾	43	43¼	Fe. 18, Ma. 1 Q	0.75
Amer. Metal, pfd. 6%	New York	115½	114	115		
Amer. Met. pfd 7%	New York	125	125	125	Fe. 18, Ma.1 Q	1.75
Amer. Sm. & Ref	New York	190¼	182¼	184¾	Ap.13, My.1 Q	2.00
Amer. Sm. & Ref. pfd	New York	142	140¼	141¾	My. 4, Jn. 1 Q	1.75
Consol. M. & S	Montreal	276¾	271	274	De. 31, Ja. 16 X	6.25
Newmont Mining	N. Y. Curb	172	165½	166¾	Ma.31, Ap.16 Q	1.00
U. S. Sm. R. & M	New York	42	41¼	41¼	Ap.5, Ap.14 Q	0.87½
U.S. Sm. R.&M. pfd	New York	53¼	53	53	Ap.5, Ap.14 Q	0.87½

*Cents per share. †Bid or asked. Q, Quarterly. A, Annual. SA, Semi-annually. M, Monthly. K, irregular. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, J. A. Hogle & Co.; Colorado Springs, Colo., Henry Sachs.

LONDON QUOTATIONS—WEEK ENDED APRIL 10, 1928

Name	High	Low	Last	Date	Amount	Last Div.
Aramayo Mines (25 frs.)	66/—	65/—	65/9	Feb., 1928	5	p.c. (†)
Burma Corpn. (10 rupees)	12/10½	12/6	12/9	Jan., 1928	6	annas*
Bwana M'Kubwa (5s)	5/6	5/1½	5/4½			
Camp Bird (2s)	5/1½	4/6	5/—	April, 1928	16¼	p.c.
El Oro (£1)	4/4½	4/—	4/3	Nov., 1924	2½	p.c.*
Frontino & Bolivia (£1)	14/4½	14/3	14/4½	Jan., 1928	5	p.c.
Mexican Corpn.(£1)	10/—	8/9	10/—			
Mexico Mines of El Oro (£1)	26/3	20/—	23/9	Dec., 1926	3¾	p.c.*
Mond Nickel	165	—150/—	162 6	Feb., 1928	7½	p.c.
N'Changa Copper Mining	11/9	11/3	11/6			
Oroville Dredging (£1)	4/—	3/9	4/—	Dec., 1923	3¾	p.c.
Rhodesian Congo Border (£1)	18/9	17/6	18/9			
St. John del Rey (£1)	13/—	11/7½	12/6	May, 1927	3¾	p.c.
San Francisco Mines (10s)	28 3	27/6	28/—	Jan., 1928	25s.	
Santa Gertrudis (£1)	15/10½	15/—	15/9	Jan., 1928	7½	p.c.
Selukwe (2s. 6d.)	14/1½	12/3	12/10½	April, 1917	6¼	p.c.
S. Amer. Copper (2s.)	2/1½	1/10½	2/1½	Nov., 1917	75	p.c.
Tanganyika (£1)	67/6	63/1½	65/—	Aug., 1927	7½	p.c.
Union Miniere de Haut-Katanga (Brussels)	8,525	8,050	8,525	July, 1927	182.60	(‡)

*Free of British income tax. †Swiss francs and plus 15 p. c. bonus. ‡Belgian frs. and free of taxation.

Current Prices of Mining Supplies

Rise and Fall of the Market

WITH the exception of a $1 per ton advance in cast-iron pipe, changes in prices of mining supplies were downward during the last month. Galvanized steel sheets are off 10c. per 100 lb., at mills. Linseed oil dropped 2½c. per 7½-lb. gal. at Minneapolis, during April. Packing, except rubber sheet, declined 5c. per lb. at New York warehouses. Manila rope is down 1c. per lb. at Chicago and 1½c. in Seattle. Mine timbers, though selling at March levels, are 6 per cent below quotations as of a year ago.

SHEETS—Quotations are per 100 lb. in various cities delivered from warehouse, also the base quotations at mill:

	Pittsburgh, Large Mill Lots	St. Louis	Chicago	San Francisco	New York
Galvanized No. 24	$3.65@$3.75	$5.25	$4.80	$5.50	$4.95

STEEL RAILS—The following quotations are per gross ton f.o.b. Pittsburgh, Chicago and Birmingham in carloads:

	Pittsburgh	Birmingham	Chicago
Standard bessemer rails	$43.00	$43.00	$43.00
Standard open hearth rails	43.00	43.00	43.00

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh mill for carloads, together with the warehouse prices at other places named:

	Pittsburgh	Chicago	St. Louis	San Francisco	Birmingham
Standard spikes, ⅝-in. and larger	$2.75–$2.80	$3.55	$3.65	$3.85	$3.00
Track bolts	3.80	4.55	4.65	5.35	3.90
Standard section angle bars, splice bars or fish plates	2.75	3.40	4.25	4.25	....

STRUCTURAL MATERIAL—Following are base prices per 100 lb. in carloads, f.o.b. mill, Pittsburgh and Birmingham. At other cities listed, quotations are per 100 lb., delivered from warehouse:

	Pittsburgh, Mill	Birmingham Mill	New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in.	$1.90	$2.00	$3.30*	$4.00	$3.25	$3.10	$3.25
Channel, 3 to 15 in.	1.90	2.00	3.30*	4.00	3.25	3.10	3.25
Angles, 3 to 6 in., ¼-in. thick	1.90	2.00	3.30*	4.00	3.25	3.10	3.25
Tees, 3 in. and larger	1.90	2.00	3.30*	4.00	3.25	3.10	3.25
Plates ¼-in. thick	1.90	2.00	3.30*	4.00	3.25	3.10	3.25

*250 to 3,999 lb.; 249 lb. and under plus extra of 50c. net per order.

WIRE ROPE—Discounts from list price, f.o.b. New York and territory east of Missouri River, on regular grades of bright and galvanized are as follows:

Cast steel round strand rope	20 %
Galvanized steel rigging and guy rope	7½%
Round strand iron and iron tiller	5 %
Plow steel round strand rope	35 %
Special steel round strand rope	30 %
Gavanized iron rigging and guy rope (add to list)	12½%

DRILL ROD (from list at warehouse): New York 60%; Cleveland 55%; Chicago 50%

WROUGHT IRON AND STEEL PIPE—The following discounts from list, are to jobbers for carloads at Pittsburgh mill:

	Steel			Iron		
	Inches	Black	Galv.	Inches	Black	Galv.
Butt Weld	⅛ to 3	62	50½	⅛ to 1¼	30	13
Lap Weld	2½ to 6	59	47½	3 to 6	28	13

WROUGHT-STEEL PIPE—From warehouses at the places named the following discounts from list hold for steel pipe:

	Black		
	New York	Chicago	St. Louis
2½ to 6 in., lap welded	48%	51%	46%

CAST-IRON PIPE—The following are prices on class B, and heavier, f.o.b. per net ton, for carloads.

	Birmingham	New York	Chicago	St. Louis	San Francisco
6 in. and over	$28.00	$37.60	$36.20	$33.60	$39.00

NUTS—Hot pressed or cold punched, square or hexagonal, blank or tapped, up to 1-in., inclusive, full packages, carry a discount of 55% from latest list, April 1, 1927, on immediate deliveries from warehouse stocks in New York and vicinity.

HOLLOW TILE—Price per block to contractors, in lots of 2000 pieces or over:

	New-York	Chicago	Philadelphia	St. Louis	San Francisco‡	Perth Amboy N. J., Factory
4x12x12	$0.1004	$0.076	$0.11	$0.078	0.108	
6x12x12	.1506	.104	.....	.105	.156	$0.252*
8x12x12	.188›	.142	.22	.145	.255	.312†

*10x12x12; †12x12x12.

MACHINE BOLTS—Square heads and nuts, up to 1x30-in., full packages discount 50% from latest list, April 1, 1927, at warehouses in New York and vicinity

LUMBER—Prices per M ft. b.m., in carloads to contractors

Rough Douglas fir, No. 1 common, at yards in San Francisco:

	10-16-18 and 20 Ft.	22 and 24 Ft
3x3 and 4	$27.00	$28.00
3x6 and 8	27.00	28.00
4x4-6 and 8	27.00	28.00

Prices are for long-leaf yellow pine timbers (rough) delivered to job:

	20 Ft. and under		22-24 Ft.		Up to 20 Ft., Pine	Up to 32 Ft., Fir*
3x4 to 8x8	$58.00@63.00		$59.00@64.00		$37.50	$39.00
3x10 to 10x10	61.00	66.00	62.00@67.00		45.00	39.00
3x12 to 12x12	68.00	73.00	6?.00@74.00		55.00	39.00

Other Cities—Price for rough timbers delivered:

	8x8-In. x 20 Ft. and Under—				12x12-In.† 20 Ft. and Under	
	Pine	Fir*	Hemlock	Spruce	Pine	Fir*
Boston	$47.50	$47.00	$48.00	$51.00	$57.00	$56.00
Cincinnati	33.00	46 00	44.00	44.00	37.00	50 00
Denver	.....	31.75	.....	.....	.....	32.75
Minneapolis (f.o.b.)	44.25	37.75	36.25	.....	48.25	38.25
Kansas City, Mo.	40.75	38.75	.....	.....	53.75	38.75
Philadelphia	48.00	35.00	40.00	43.00	60.00	35.00

*Douglas fir. †3x12 to 12x12 in. Chicago price is on S4S.

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh Mill	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	$2.65	$3.10	$3.60	$4.00	$2.83½	$4.95
Cut	2.80	.....	5.00	5.00	.....	5.00

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots *without charge for bags*. Cash discount not deducted.

	Current	One Month Ago	One Year Ago
New York, del. by truck	$2.25@2.35	$2.25@$2.35	$2.35@$2.50
Chicago, f.o.b.	2.05	2.05	2.05
Cleveland, f.o.b.	2.24	2.24	2.24

LIME—Delivered; New York quotes bbl. 280 lb. net; Chicago, 180 lb.:

	Hydrated, per Ton—		Lump, per Barrel —	
	Finishing	Common	Finishing	Common
New York	$21.00@22.00	$14.00@15.00	$4.00 4.10	$3.15@ 3.25
Chicago	20.00	18.00	.....	1.50

LINSEED OIL—These prices are 7½-lb. per gallon:

	New York	Chicago	Minneapolis
Raw in barrels (5 bbl. lots)	$0.76½	$0.78	$0.84½

WHITE AND RED LEAD—Per 100-lb. keg base price, f.o.b. New York.

	Dry	In Oil
Red	$13.75	$15.25
White	13.75	13.75

HOSE—Quotations at New York warehouses:

Fire Protection — 50-Ft. Lengths $0.68 per ft.

Underwriters' 2½-in. coupled, single jacket (net)

Air—Best Grade

¾-in., per ft. 3 ply $0.36½ 4 ply $0.44

Steam—Discounts from List

First grade 30–10% Second grade 40% Third grade 45%

RUBBER BELTING—List price 6-in., 6 ply, $1.83 per lin.ft. for rubber transmission belting. Discounts from list are as follows:

Best grade 45% Second grade 50%

LEATHER BELTING—List price, 24c. per lin.ft. per inch of width for single ply, at New York warehouses:

Grade	Discount from list
Medium	35%
Heavy	30%

PACKING—Prices per pound at New York warehouse:

Rubber and duck for low-pressure steam, ⅛ in.	$0.90
Rubber sheet	.55
Rubber sheet wire insertion	.75

MANILA ROPE—Per lb., ¾-in. and larger, 1,200-ft. coils

Atlanta	$0.22	New Orleans	$0.23½
New York	.26	Seattle	.21½
Chicago	.21	San Francisco	.23½

EXPLOSIVES—Prices per pound for dynamite in small lots:

	Gelatin 40%	Gelatin 60%
New York	$0.265	$0.2875
Minneapolis	.2017	.2223
Denver	.1975	.22
Seattle	.16	.185
Cincinnati	.22	.245
San Francisco	.1625	.1925

FLOTATION OIL—Pine tar, 50 gal. bbl., gross weight 500 lb., f.o.b. New York, carload lots, per gal. $0.33

CHEMICALS—Prices for round lots in New York market, per lb.:

Zinc dust, 550 lb. casks	$0.09@.10
Litharge, casks	.08½
Sodium cyanide, 220 lb. single case lots	.18@.22
Calcium carbide, in drums	.05@.06